

Job's Tears

Contents

1	Beneficial weed	1
1.1	Soil health	1
1.2	Pest prevention	1
1.2.1	Trap crops	1
1.2.2	Host-finding disruption	3
1.3	Companion plants	4
1.3.1	Green mulch	5
1.4	Herbicide	5
1.5	Beneficial insects	5
1.6	Uses for Humans	5
1.7	Examples	5
1.8	References	6
1.9	Further reading	6
1.10	External links	6
2	Failure in the intelligence cycle	8
2.1	Requirements	8
2.2	Collection	8
2.2.1	HUMINT	8
2.2.2	SIGINT	8
2.2.3	IMINT	9
2.2.4	OSINT	10
2.2.5	MASINT	10
2.3	Processing And Exploitation	10
2.3.1	Failures in Processing	10
2.4	Analysis And Production	10
2.4.1	Tactical/Operational	11
2.4.2	Analysts	11
2.5	Dissemination And Consumption	11
2.5.1	Failures in Dissemination	11
2.6	Feedback	11
2.6.1	Failures in Feedback	11
2.7	See also	12

2.8	References	12
3	Job's tears	13
3.1	Taxonomy	13
3.2	Uses	14
3.3	References	15
3.4	Further reading	16
3.5	External links	16
4	John Titor	17
4.1	Titor's posts	17
4.1.1	Outline	17
4.1.2	Time machine	18
4.1.3	Predictions	18
4.2	Criticism and discussion	19
4.2.1	Predictive failures	19
4.2.2	Story and consistency	19
4.2.3	Technology	20
4.3	Investigations	20
4.4	In popular culture	20
4.5	References	20
4.6	External links	21
5	Juvenilia	22
5.1	References	22
6	Kinetic bombardment	23
6.1	Real life concepts and theories	23
6.2	In science fiction	24
6.3	See also	25
6.4	References	25
6.5	Further reading	26
6.6	External links	26
7	KISS principle	27
7.1	Origin	27
7.2	Variants	27
7.3	In film animation	28
7.4	In software development	28
7.5	See also	28
7.6	References	28
7.7	External links	29
8	Knock-and-announce	30

8.1	The rule	30
8.2	Effects of the rule	31
8.3	See also	31
8.4	References	31
9	LANTIRN	33
9.1	Features	33
9.1.1	AN/AAQ-13 navigation pod	34
9.1.2	AN/AAQ-14 targeting pod	34
9.2	Background	34
9.3	LANTIRN and the F-14 Tomcat	34
9.4	General Characteristics	36
9.5	See also	36
9.6	References	36
9.7	External links	36
10	Last meal	37
10.1	Contemporary restrictions	37
10.2	Documented last meal requests	37
10.2.1	Europe	37
10.2.2	Asia	38
10.2.3	Canada	38
10.2.4	United States	38
10.2.5	Other prisoner requests	39
10.3	See also	43
10.4	References	43
10.5	Further reading	45
10.6	External links	46
11	Law of Jante	47
11.1	Definition	47
11.2	Present	48
11.3	See also	48
11.4	References	48
11.5	Further reading	48
12	Leftovers	50
12.1	Leftover cuisine	51
12.2	Doggy bag	52
12.3	See also	52
12.4	References	54
13	Lesser Key of Solomon	55

13.1	<i>Ars Goetia</i>	55
13.1.1	The Seventy-Two Demons	55
13.2	<i>Ars Theurgia Goetia</i>	59
13.3	<i>Ars Paulina</i>	59
13.4	<i>Ars Almadel</i>	59
13.5	<i>Ars Notoria</i>	59
13.6	Editions and translations	59
13.7	Notes	60
13.8	References	60
13.9	External links	61
14	Limited hangout	62
14.1	Modified limited hangout	62
14.2	See also	62
14.3	References	62
15	Limonana	64
15.1	Etymology	64
15.2	History	64
15.3	See also	64
15.4	References	64
16	Lingchi	67
16.1	Etymology	68
16.2	Description	68
16.3	Western perceptions	68
16.4	History	69
16.5	Published accounts	71
16.5.1	Photographs	71
16.6	Popular references	72
16.6.1	Non-fiction	72
16.6.2	Literature	72
16.6.3	Film	73
16.6.4	Music	73
16.6.5	Television	73
16.7	See also	73
16.8	Notes	74
16.9	References	76
17	List of diseases of the honey bee	77
17.1	Pests and parasites	77
17.1.1	<i>Varroa</i> mites	77
17.1.2	Acarine (tracheal) mites	78

17.1.3	Nosema disease	79
17.1.4	Small hive beetle	79
17.1.5	Wax moths	80
17.1.6	<i>Tropilaelaps</i>	81
17.2	Bacterial diseases	82
17.2.1	American foulbrood	82
17.2.2	European foulbrood	82
17.3	Fungal diseases	82
17.3.1	Chalkbrood	82
17.3.2	Stonebrood	82
17.4	Viral diseases	83
17.4.1	Cripaviridae	83
17.4.2	Dicistroviridae	83
17.4.3	Cloudy wing virus	84
17.4.4	Sacbrood virus	84
17.4.5	Iflaviridae	84
17.4.6	Iridoviridae	85
17.4.7	Secoviridae	85
17.4.8	Lake Sinai virus	85
17.5	Dysentery	85
17.6	Chilled brood	85
17.7	Pesticide losses	86
17.8	Colony collapse disorder	86
17.9	References	86
17.10	Further reading	89
17.11	External links	89
18	List of intelligence gathering disciplines	90
18.1	HUMINT	90
18.2	GEOINT	90
18.3	MASINT	90
18.4	OSINT	91
18.5	SIGINT	92
18.6	TECHINT	92
18.7	CYBINT/DNINT	92
18.8	FININT	92
18.9	See also	92
18.10	References	92
19	Living creatures (Bible)	93
19.1	Ezekiel's four living creatures	93
19.2	Daniel's four living creatures	94

19.3	Revelation's four living beings	94
19.4	Religious views	94
19.5	See also	95
19.6	References	95
19.7	External links	95
20	Lost, mislaid, and abandoned property	96
20.1	Lost property	96
20.1.1	Animals	97
20.1.2	Slaves	97
20.1.3	Unclaimed property	97
20.2	Mislaid property	97
20.3	Abandoned property	98
20.3.1	Treasure trove	98
20.4	Recent developments	99
20.5	See also	99
20.6	References	99
20.7	External links	100
21	Lovers rock	101
21.1	History	101
21.2	See also	102
21.3	References	102
22	Magnetism	103
22.1	History	104
22.2	Sources of magnetism	105
22.3	Materials	107
22.3.1	Diamagnetism	107
22.3.2	Paramagnetism	108
22.3.3	Ferromagnetism	109
22.3.4	Antiferromagnetism	110
22.3.5	Ferrimagnetism	110
22.3.6	Superparamagnetism	111
22.3.7	Other types of magnetism	111
22.4	Electromagnet	112
22.5	Magnetism, electricity, and special relativity	112
22.6	Magnetic fields in a material	113
22.7	Magnetic force	114
22.8	Magnetic dipoles	115
22.8.1	Magnetic monopoles	115
22.9	Quantum-mechanical origin of magnetism	116

22.10Units	116
22.10.1 SI	116
22.10.2 Other	116
22.11Living things	117
22.12See also	117
22.13References	117
22.14Further reading	118
22.15External links	119
23 Mahabharata	120
23.1 Textual history and structure	121
23.1.1 Accretion and redaction	122
23.1.2 Historical references	122
23.1.3 The 18 parvas or books	124
23.2 Historical context	124
23.3 Synopsis	125
23.3.1 The older generations	126
23.3.2 The Pandava and Kaurava princes	127
23.3.3 Lakshagraha (the house of lac)	127
23.3.4 Marriage to Draupadi	129
23.3.5 Indraprastha	130
23.3.6 The dice game	130
23.3.7 Exile and return	131
23.3.8 The battle at Kurukshetra	131
23.3.9 The end of the Pandavas	131
23.3.10 The reunion	132
23.4 Themes	133
23.4.1 Just war	134
23.5 Versions, translations, and derivative works	134
23.5.1 <i>Critical Edition</i>	134
23.5.2 Regional versions	134
23.5.3 Translations	135
23.5.4 Derivative literature	135
23.5.5 In film and television	136
23.6 Jain version	136
23.7 Kuru family tree	136
23.8 Cultural influence	137
23.9 Editions	137
23.10References	137
23.11Sources	140
23.12External links	141

24 Malthusian catastrophe	145
24.1 Thomas Malthus	145
24.2 Neo-Malthusian theory	146
24.3 Criticism	148
24.4 See also	149
24.5 Notes	150
24.6 References	150
24.7 External links	151
25 Man bites dog (journalism)	152
25.1 Examples of literal use in journalism	152
25.2 References	153
26 Mandelbrot set	155
26.1 History	156
26.2 Formal definition	157
26.3 Basic properties	159
26.4 Other properties	161
26.4.1 Main cardioid and period bulbs	162
26.4.2 Hyperbolic components	164
26.4.3 Local connectivity	164
26.4.4 Self-similarity	164
26.4.5 Further results	165
26.4.6 Relationship with Julia sets	165
26.5 Geometry	166
26.5.1 Image gallery of a zoom sequence	168
26.6 Generalizations	172
26.7 Other, non-analytic, mappings	173
26.8 Computer drawings	174
26.8.1 Escape time algorithm	174
26.8.2 Distance estimates	177
26.8.3 Optimizations	180
26.9 References in popular culture	183
26.10 See also	183
26.11 References	183
26.12 Further reading	185
26.13 External links	185
27 Marocchine	186
27.1 Background	187
27.2 Mass rape	187
27.3 Cultural depictions	187

27.4 Criticism	187
27.5 Notes	187
27.6 References	188
27.7 External links	189
28 Mayflower	190
28.1 <i>Mayflower</i> structure and layout	190
28.1.1 General layout	190
28.2 Early history	191
28.3 Voyage	192
28.3.1 <i>Speedwell</i> and <i>Mayflower</i>	192
28.3.2 <i>Mayflower</i> sets sail	192
28.3.3 Arrival in America	194
28.3.4 First winter	195
28.4 Passengers	195
28.5 <i>Mayflower</i> officers, crew, and others	196
28.5.1 Crew members per various sources	196
28.5.2 Officers and crew	196
28.5.3 Known <i>Mayflower</i> seamen	198
28.5.4 Unidentified passenger	198
28.6 Later history	198
28.7 Second <i>Mayflower</i>	198
28.8 Place in history	199
28.9 See also	199
28.10References	199
28.11Further reading	202
28.12External links	202
29 Miasma theory	206
29.1 Etymology	207
29.2 Views worldwide	207
29.2.1 China	207
29.2.2 Influence in Southern China	209
29.3 Developments from 19th century onwards	209
29.3.1 Zymotic theory	209
29.3.2 Contagionism versus miasmatism	210
29.3.3 Influence on sanitary engineering reforms	210
29.3.4 From miasma to germ theory	211
29.4 See also	212
29.5 References	212
29.6 Further reading	213
29.7 External links	214

30 Milieu control	215
30.1 Background	215
30.2 See also	215
30.3 References	215
30.4 External links	215
31 Military Assistance Command, Vietnam – Studies and Observations Group	216
31.1 Foundation	216
31.2 Gulf of Tonkin incident	217
31.3 <i>Shining Brass</i>	218
31.4 <i>Daniel Boone</i>	219
31.5 Black year – 1968	223
31.6 <i>Commando Hunt</i>	225
31.7 Laos and Cambodia	225
31.8 Withdrawal	226
31.9 Recognition	227
31.10 Technology	228
31.11 In popular culture	228
31.12 See also	228
31.13 Footnotes	228
31.13.1 Notes	229
31.14 References	229
31.15 Sources	231
31.16 External links	233
32 Mirepoix (cuisine)	234
32.1 History	235
32.2 International versions	235
32.2.1 German <i>Suppengrün</i>	235
32.2.2 Italian <i>soffritto</i>	236
32.2.3 Polish <i>włoszczyzna</i>	236
32.3 References	236
32.4 External links	238
33 Mosaic (genetics)	239
33.1 Types	239
33.1.1 Somatic mosaicism	239
33.1.2 Germline mosaicism	240
33.2 Use in experimental biology	240
33.3 History	241
33.4 See also	241
33.5 References	241

33.6 Further reading	242
34 Most-wanted Iraqi playing cards	243
34.1 About the cards	243
34.1.1 Spades	244
34.1.2 Clubs	245
34.1.3 Hearts	246
34.1.4 Diamonds	246
34.1.5 Other	248
34.2 See also	248
34.3 Sources	248
35 Multimarket contact	250
35.1 References	250
36 Mushin (mental state)	251
36.1 See also	251
36.2 References	252
37 Mutual assured destruction	253
37.1 Theory	254
37.2 History	254
37.2.1 Pre-1945	254
37.2.2 Early Cold War	254
37.2.3 Two doomsday devices	255
37.2.4 Strategic Air Command	257
37.2.5 Retaliation capability (second strike)	257
37.2.6 ABMs threaten MAD	259
37.2.7 MIRVs	259
37.2.8 Late Cold War	261
37.2.9 Post-Cold War	262
37.3 Official policy	262
37.4 Criticism	263
37.5 See also	264
37.6 References	264
37.7 External links	265
38 Neutering	268
38.1 Methods of sterilization	268
38.1.1 Females (spaying)	268
38.1.2 Males (castration or vasectomy)	270
38.1.3 Nonsurgical alternatives	270
38.1.4 Surgical alternatives	271

38.2	Early-age neutering	271
38.3	Health and behavioral effects	272
38.3.1	Advantages	272
38.3.2	Disadvantages	273
38.3.3	Current research	274
38.4	Terminology for neutered animals	274
38.5	Religious views	275
38.5.1	Islam	275
38.5.2	Judaism	275
38.6	See also	275
38.7	References	275
38.8	External links	279
39	New World vulture	281
39.1	Taxonomy and systematics	281
39.1.1	Extinct species and fossils	282
39.2	Description	283
39.3	Distribution and habitat	284
39.4	Behaviour and ecology	284
39.4.1	Feeding	285
39.4.2	Tolerance to bacterial toxins in decaying meat	285
39.4.3	Breeding	286
39.5	Status and conservation	286
39.6	In culture	286
39.7	See also	286
39.8	Notes	286
39.9	References	288
39.10	External links	290
40	NIMBY	291
40.1	Claimed rationale	292
40.2	Origin and history	293
40.3	Variations	294
40.3.1	Not in My Neighborhood	294
40.3.2	NIABY	294
40.3.3	NAMBI	294
40.3.4	BANANA	294
40.3.5	PIBBY	294
40.3.6	FRUIT	295
40.3.7	SOBBY	295
40.4	Points of debate	295
40.4.1	In favor of development	295

40.4.2 In favor of local sovereignty	295
40.5 Examples	295
40.5.1 Canada	295
40.5.2 United Kingdom	296
40.5.3 Hong Kong	297
40.5.4 Italy	297
40.5.5 Japan	297
40.5.6 United States	297
40.6 See also	299
40.7 References	299
40.8 External links	302
41 OODA loop	303
41.1 Overview	303
41.2 Applicability	304
41.3 See also	305
41.4 Notes	305
41.5 References	306
41.6 External links	306
42 "Ramayana"	307
42.1 Etymology	307
42.2 Textual history and structure	307
42.3 Period	310
42.4 Characters	311
42.4.1 Ikshvaku dynasty	311
42.4.2 Allies of Rama	312
42.4.3 Foes of Rama	314
42.5 Synopsis	314
42.5.1 <i>Bala Kanda</i>	315
42.5.2 <i>Ayodhya Kanda</i>	315
42.5.3 <i>Aranya Kanda</i>	317
42.5.4 <i>Kishkindha Kanda</i>	319
42.5.5 <i>Sundara Kanda</i>	319
42.5.6 <i>Yuddha Kanda</i>	320
42.5.7 <i>Uttara Kanda</i>	321
42.6 Versions	321
42.6.1 In India	322
42.6.2 In Nepal	325
42.6.3 Southeast Asian	325
42.6.4 Critical edition	326
42.7 Influence on culture and art	327

42.8 Religious significance	328
42.9 Ramayana in popular culture	328
42.9.1 Stage	328
42.9.2 Movies	330
42.9.3 Plays	331
42.9.4 TV series	331
42.10 See also	332
42.11 Citations	332
42.12 References	333
42.13 Further reading	334
42.14 External links	334
43 Toyota Production System	335
43.1 Goals	335
43.2 Concept of TPS	335
43.3 Origins	336
43.4 Principles	336
43.4.1 Continuous improvement	336
43.4.2 Respect for people	336
43.4.3 Long-term philosophy	337
43.4.4 The right process will produce the right results	337
43.4.5 Add value to the organization by developing your people and partners	337
43.4.6 Continuously solving root problems drives organizational learning	337
43.5 Sharing	337
43.6 <i>Workplace Management</i>	338
43.7 Commonly used terminology	338
43.8 See also	339
43.9 References	339
43.10 Bibliography	339
43.11 External links	340
43.12 Text and image sources, contributors, and licenses	341
43.12.1 Text	341
43.12.2 Images	353
43.12.3 Content license	363

Chapter 1

Beneficial weed

A **beneficial weed** is a **plant** not generally considered **domesticated** and often viewed as a **weed** but which has some **companion plant** effect, is edible, contributes to **soil health**,^[1] or is otherwise **beneficial**. Beneficial weeds include many **wildflowers**, as well as other weeds that are commonly removed or **poisoned**.

1.1 Soil health

Although erroneously assumed to compete with neighboring plants for food and moisture, some “weeds” provide the soil with nutrients, either directly or indirectly.

- For example, **legumes**, such as **white clover**, if they are colonized by the right bacteria (Rhizobium most often) add **nitrogen** to the soil through the process of **nitrogen fixation**, where the bacteria has a symbiotic relationship with its hosts roots, “fixing” atmospheric nitrogen (combining it with oxygen or hydrogen) making the nitrogen plant-available (NH₄ or NO₃).
- Others use deep tap roots to bring up nutrients and moisture from beyond the range of normal plants so that the soil improves in quality over generations of that plant's presence.
- Weeds with strong, widespread roots also introduce organic matter to the earth in the form of those roots, turning hard, dense clay dirt into richer, more fertile soil.
- Some plants like tomatoes and corn will “piggyback” on nearby weeds, allowing their relatively weak root systems to go deeper.

1.2 Pest prevention

Many weeds protect nearby plants from insect pests.

Some beneficial weeds repel insects and other pests through their smell, for example **alliums** and **wormwood**. Some weeds mask a companion plant's scent, or the pheromones of pest insects, as with **ground ivy**, as well as **oregano** and other **mints**.

Some also are unpleasant to small animals and ground insects, because of their spines or other features, keeping them away from an area to be protected.

1.2.1 Trap crops

Some weeds act as **trap crops**, distracting pests away from valued plants. Insects often search for target plants by smell, and then land at random on anything green in the area of the scent. If they land on an edible “weed”, they will stay there instead of going on to the intended victim. Sometimes, they actively prefer the trap crop.



Clover was once included in grass seed mixes, because it is a legume that fertilizes the soil



Dandelions benefit neighboring plant health by bringing up nutrients and moisture with its deep tap root

1.2.2 Host-finding disruption

Recent studies on host-plant finding have shown that flying pests are far less successful if their host-plants are surrounded by any other plant or even “decoy-plants” made of green plastic, cardboard, or any other green material.

- First, they seek plants by scent. Any “weed” that has a scent reduces the odds of them finding crop plants. Examples are Crow Garlic (wild chives) and Ground Ivy (a form of wild mint), both dramatically masking both plant scent and insect pheromones. They cut down Japanese beetle infestation, and caterpillar infestation, for example cabbage worm, tomato hornworm, and even squash bugs.
- Second, once an insect is near its target, it avoids landing on dirt, but lands on the nearest green thing. Bare earth gardening helps them home in perfectly on the victim crop. But if one is using “green mulch”, even grass or clover, the odds are that they will make what’s called an “inappropriate landing” on some green thing they don’t want. They will then fly a short distance at random, and land on any other green thing. If they fail to accidentally hit the right kind of plant after several tries, they give up.
- If they plan to lay eggs on the crop, weeds provide one more line of defense: Even if they find the right plant, in order to ensure that they didn’t hit on a dying plant or falling leaf, they then make short leaf-to-leaf flights before laying eggs. They must land on the “right kind of leaf” enough times in sequence, before they will



Crow garlic, like any allium, masks scents from pest insects, protecting neighboring plants

risk laying their eggs. The more other greenery is nearby, the harder it is for them to remain on target and get enough reinforcement. Enough “inappropriate landings”, and they give up, heading elsewhere.

One scientific study said that simply having clover growing nearby cut the odds of cabbage root flies hitting the right plant from 36% to 7%.^{*} [2]

1.3 Companion plants

Many plants can grow **intercropped** in the same space, because they exist on different levels in the same area, providing ground cover or working as a trellis for each other.^{*} [3] This healthier style of horticulture is called **forest gardening**. Larger plants provide a wind break or shelter from noonday sun for more delicate plants.

1.3.1 Green mulch

Conversely, some intercropped plants provide **living mulch** effect, used by inhibiting the growth of any weeds that are actually harmful, and creating a humid, cooler microclimate around nearby plants, stabilizing soil moisture more than they consume it for themselves.

Plants such as **ryegrass**, **red clover**, and **white clover** are examples of “weeds” that are living mulches, often welcomed in horticulture.

1.4 Herbicide

Repel plants or **fungi**, through a chemical means known as **allelopathy**.^{*}[4] Specific other plants can be bothered by a chemical emission through their roots or air, slowing their growth, preventing seed germination, or even killing them.

1.5 Beneficial insects

A common companion plant benefit from many weeds is to attract and provide habitat for **beneficial insects** or other organisms which benefit plants.

For example, wild **umbellifers** attract predatory wasps and flies. The adults eat nectar, but they feed common garden pests to their offspring .

Some weeds attract **ladybugs** or the “good” types of **nematode**, or provide ground cover for predatory beetles.

1.6 Uses for Humans

- Some **beneficial weeds**, such as **lamb's quarters** and **purslane**, are edible. This **list of edible flowers** includes many **wildflowers** that are considered weeds when not planted intentionally. **Dandelion** is an example of an edible weed (see **dandelion wine**, **dandelion coffee**).
- A number of weeds have been proposed as natural alternate sources for latex (rubber), including **goldenrod**, from which the tires were made on the car famously given by **Henry Ford** to **Thomas Edison**.
- **Cocklebur** and stinging nettle have been used for **natural dyes**.
- Some plants seem to subtly improve the flavor of other plants around them, for example **stinging nettle**, besides being edible if properly cooked, seems to increase essential oil production in nearby herbs.^{*}[5]

1.7 Examples

Further information: **List of beneficial weeds**

See also: **List of companion plants**

- **Clover** is a legume. Like other beans, it hosts bacteria that **fix nitrogen** in the soil. Its vining nature covers the ground, sheltering more moisture than it consumes, providing a humid, cooler microclimate for surrounding plants as a “green mulch” . It also is preferred by rodents over many garden crops, reducing the loss of vegetable crops.
- **Dandelions** possess a deep, strong **tap root** that breaks up hard soil, benefiting weaker-rooted plants nearby, and draw up nutrients from deeper than shallower-rooted nearby plants can access. They will also excrete minerals and nitrogen through their roots.^{*}[6]
- **Crow garlic**, the wild chives found in sunny parts of a North American yard, has all of the companion plant benefits of other **alliums**, including repelling **japanese beetles**, **aphids**, and rodents, and being believed to benefit the flavor of **solanums** like tomatoes and peppers. It can be used as a substitute for garlic in cooking, though it may lend a bitter aftertaste.

- **Bishop's lace** (Queen Anne's Lace) works as a **nurse plant** for nearby crops like **lettuce**, shading them from overly intense sunlight and keeping more humidity in the air. It attracts predatory wasps and flies that eat vegetable pests. It has a scientifically tested^{*}[7] beneficial effect on nearby tomato plants. When it is young it has an edible root, revealing its relationship to the domesticated **carrot**.

1.8 References

- [1] Cocannouer, Joseph A. (1950), *Weeds, Guardians of the Soil* (PDF), The Devin-Adair Company.
- [2] Horticulture Research International, Wellesbourne : “Insects can see clearly now the weeds have gone.” Finch, S. & Collier, R. H. (2003). *Biologist*, 50 (3), 132-135.
- [3] Ussery, Harvey. “Plant an Edible Forest Garden” . *Motherearthnews.com*. Retrieved 2012-06-13.
- [4] “Allelopathic effects of western ragweed on seed germination and seedling growth of selected plants” . *Journal of Chemical Ecology*. SpringerLink. **9**: 1073–1078. doi:10.1007/BF00982212. Retrieved 2012-06-13.
- [5] Burnett, Bruce. “Stinging Nettle: Companion Plant and Medicinal Herb” . *BCLiving*. Retrieved July 21, 2013.
- [6] Anon. “Companion Planting for Vegetables & Plants” . *Country living and farm lifestyles*. countryfarm-lifestyles.com. Retrieved 2011-03-07.
- [7] “Scribd” . *Scribd*. Retrieved 2012-06-13.

1.9 Further reading

- Schoonhoven, L.M., J. J. A van Loon, and Marcel Dicke. 2005. *Insect-plant biology*. Oxford University Press, London.
- **Cover Crops - Living Mulches**

1.10 External links

- **Plants for a future -- Useful weeds**
- **Discover Beneficial Weeds in the Garden** —offers a list of “soil indicator” weeds
- **Insect Olfaction of Plant Odour**



Queen Anne's Lace provides shelter to nearby plants, as well as attracting predatory insects that eat pests like caterpillars, and may boost the productivity of tomato plants

Chapter 2

Failure in the intelligence cycle

For the album see [Intelligence Failure](#)

Failure in the intelligence cycle or **intelligence failure**, is the outcome of the inadequacies within the [intelligence cycle](#). The intelligence cycle itself consists of six steps that are constantly in motion. The six steps are: requirements, [collection](#), processing and exploitation, [analysis](#) and production, [dissemination](#) and consumption, and feedback. ^[1]

2.1 Requirements

Requirements in the intelligence cycle relate to what the decision maker is requesting the analyst or team of analysts to research or find for him/her. These requirements may fall under any of the collection methods. Also, the requirements put forth should be an adjunct to policy making, not policy making itself. Ideally, the decision maker will provide the analyst with a clear set of requirements when they request information as to make the cycle flow easier. ^[2]

However, this is often not the case. Often requirements are too broad or not broad enough and it causes the analyst to make decisions on their own as to how to fill in the gaps in the requirements. However, the analysts could run into the problem of filling the gaps the wrong way and searching for the wrong information.

2.2 Collection

The process of collection in the intelligence cycle refers to the methods used to gather raw data for the later stages of the cycle. There are five collection methods and each have ways in which they can fail. The five methods are: Human Intelligence ([HUMINT](#)), Signals Intelligence ([SIGINT](#)), Image Intelligence ([IMINT](#)), Open Source Intelligence ([OSINT](#)), and Measures and Signature Intelligence ([MASINT](#)). ^[3] It is common to rely on technology when performing collection, however it can fail and cause more problems than it solves. ^[4]

2.2.1 HUMINT

See [HUMINT](#)

Failures in HUMINT

2.2.2 SIGINT

Signals intelligence is the information collected via the interception of signals. Signals intelligence can further be broken down into Communications Intelligence ([COMINT](#)), Electronic Intelligence ([ELINT](#)), Telemetry Intelligence ([TELINT](#)), and Radar Transmitters ([RADINT](#)). ^[5] While these systems have their strengths, such as the ability to intercept communication or to gain information about weapons systems, they also have their weaknesses.

COMINT

Gaining accurate communications intelligence can be achieved but more often than not, the adversary will not communicate in such a way that would allow the information to be intercepted easily. The classic case of communications intelligence failure is **Operation Gold** during the Cold War where the Central Intelligence Agency and the British Secret Intelligence Service planned to tap landline communications to the Soviet Army headquarters in Berlin. The Soviets were alerted to the plan by a mole within the SIS and they allowed the operation to go forward. The information that was given out via the tap was disinformation by the Soviets. Thus leading to a failure in the intelligence itself.

Another setback in communication intelligence is code breaking. This falls into two categories: verbal codes, and transmitted codes. For an analyst listening to an intercepted phone call, the process of gaining information may seem simple. However, the situation becomes complicated when the individuals begin to use “slang” or colloquialisms in their conversation. What seems like a harmless conversation could prove dangerous. Furthermore, the calls themselves may be encrypted as well, further complicating the problem. Secondly, there is the issue of transmitted information being encoded. Lowenthal states in collection portion of his book that codebreakers like to boast that any code that can be created can be solved,* [6] but the public has access to increasingly stronger cipher programs now* [7] and these programs are harder to break.

ELINT, TELINT, RADINT

These three “ints” relate to each other and separate discussion of them would be pointless. Simple procedures can be taken to reduce the chances of information being received by a gathering method. As was mentioned before with communication, test data or telemetry data can be encoded before it is sent. It can also be encapsulated and released for pick up.* [6]

2.2.3 IMINT

Imagery intelligence refers to information gathered by planes, **unmanned aerial vehicles**(UAV), and satellites.

Satellites

Failures to gain intelligence via satellites varies from the meteorological to the human, all of which are important to explaining why this important method of collection fails.

Matters of weather play a large role in IMINT failure. While radar imaging can see through clouds, it is unlikely that a general satellite sweep could find something buried under a few feet of snow or in a frozen lake.* [8] Another problem with satellite imagery is that it is a simple snapshot in time. If the satellite that captures the image is not in a geo-synchronous orbit, there is a risk of the target not being there when the satellite **passes** over the area again. There is also the possibility of camouflage. For example, the entrance to an underground bunker may be camouflaged with foliage and it would take an arduous examination of the image to find the information needed. Another potential failure is a satellite being unavailable at the time needed because it is being used for other intelligence purposes, and the situation or event of interest is missed. Images can also be misinterpreted, generating misleading information and potentially supporting a bad decision.

Airplanes and UAV's

Airplanes and UAV's provide a quick response to the tasking issue of satellites. They have fewer issues of failure, however their failures tend to be greater in magnitude. Intelligence failure with planes and UAV's is limited to three situations. The first situation is poor tasking. If the plane or the UAV is sent to the wrong destination or the coordinates were misinterpreted, then it is unlikely that the information will be collected. Secondly there is the issue of the aircraft being destroyed. Unless the pilot was transmitting their imagery directly to headquarters, the information would not survive. Lastly, and this applies to planes only, capture of the pilot or the plane is a failure to collect the information.

2.2.4 OSINT

Open source information is derived from newspapers, journals, radio and television, and the Internet.* [9] There is a growing emphasis on the use of OSINT however, there are several points where collection via OSINT can fail.

Information Reliability

Source reliability is one of the major points that hinders collection with this method. If you are viewing the paper of country where the dictator government runs the media, it is unlikely that you are reading an unbiased account of the facts. The same thing applies to use of the internet to gain information. Censorship controls over the internet in some countries will limit the amount of information that is made available.

Issues with Analysts

From the standpoint of the analyst themselves, there are also issues regarding the use of OSINT. Most individuals scan a webpage for the information they need and if it is not there, they move on. This transfers to the analytic community as well. Secondly, it is hard for an analyst to get information via the internet when most analysts lack the use of the internet in their agencies. Thirdly, the volume of data alone is often too much for an analyst to sift through causing important knowledge to slip by.* [9]

2.2.5 MASINT

Measurement and Signature Intelligence (MASINT) is scientific and technical intelligence information obtained by quantitative and qualitative analysis of data (metric, angle, spatial, wavelength, time dependence, modulation, plasma, and hydromagnetic) derived from specific technical sensors for the purpose of identifying any distinctive features associated with the source, emitter, or sender and to facilitate subsequent identification and/or measurement of the same.* [10]

Points of failure for MASINT

MASINT is hardly understood by most analysts or the decision makers that look at it and that in itself is one of its major drawbacks. It also suffers from finance issues due to the expensive nature of the items needed to do the actual collection itself. Lastly, the exploitation, and analysis often take longer due to the need for highly trained analysts to examine the information.

2.3 Processing And Exploitation

Processing and exploitation involves converting the vast amount of information collected to a form usable by analysts. This is done through a variety of methods including decryption, language translation, and data reduction. Processing includes the entering of raw data into databases where it can be exploited for use in the analysis process.* [11]

2.3.1 Failures in Processing

The problem within this step of the process is that there is often too much information and not enough analysts to process it. This leads to large amounts of information that was collected never being utilized because it does not meet the *exact* needs for the collection requirement. Thus important data may be cast aside and never used even though it may be relevant again at a later date.

2.4 Analysis And Production

Analysts are the voice of the Intelligence Community.* [12] Therefore, the analysis that they perform is expected to be accurate on a regular basis. Failure in analysis can be approached from two points of view: the tactical/operational

point of view and the analysts point of view.

2.4.1 Tactical/Operational

A problem occurs when looking at current issues versus long-term issues. Ideally the tasking should be 50/50 so that no one type of issue gets more analysis than the other. In an ever changing world there is a tendency to place more emphasis on tactical/current issues. This hinders the operational/long term issues by putting analysis of them off in favor of current issues.

2.4.2 Analysts

The tasking itself is not the only way in which analysis can fail. The human component of analysis is just as important. One of the leading causes of analyst failure is **cognitive bias**. Cognitive biases are mental errors caused by our simplified information processing strategies. In other words, a cognitive bias does not result from any emotional or intellectual predisposition toward a certain judgment, but rather from subconscious mental procedures for processing information.*[13] These biases can occur not only with a single analyst but to an entire office of them, leading to a biased form of "**groupthink**". Other forms of bias such as cultural, organizational, or bias from the analysts self-interest and need to succeed. The need to succeed coupled with the level of competition within the community to get their analysis on the desk of a top decision maker. Another point of failure is with the training of the analysts or the lack of. The "Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction Report to the President of the United States" found that there is a lack of analysts with the proper scientific or technological training needed to perform proper analysis, thus contributing to failure of analysis.*[12]

2.5 Dissemination And Consumption

When the decision maker receives a report from an analyst and reviews it, this process is referred to as dissemination and consumption. In the intelligence community, there are several types of documents that get disseminated regularly. For example, the Presidents Daily Brief (PDB) is a document that is disseminated to the president of the United States on a daily basis and includes the recent information on important matters. The goal of dissemination is simple, get the information that is relevant to the decision maker in a timely fashion while being accurate.

2.5.1 Failures in Dissemination

Perhaps the greatest failure in dissemination of information is the failure to get the information to the proper decision maker. A report on crop futures in Burkina Faso would not be of interest to the Secretary of Education for example. Another issue to consider for the crop report would be if it is important enough to report. If the information does not meet a certain requirement there is a chance that it will not be reported. However, if it is important enough to report, how quickly should it be reported? If the information is time sensitive but it is not disseminated in enough time to have the desired effect then the process fails. Compartmentalization, either in isolation of planners from flow of intelligence or invocation of **need to know** among analysts, strongly contributes to failures in dissemination.

2.6 Feedback

Feedback is the last step in the intelligence process. The goal of the feedback part of the cycle is to give feedback to the analysts about the quality of the product they produced.

2.6.1 Failures in Feedback

The main failure when it comes to feedback is when the decision maker fails to offer it to the analyst. It is possible for there to be feedback failure even if feedback is offered. This occurs when the decision maker fails to get the feedback to the analyst in a timely order that would assist in the production of the next report to them.

2.7 See also

- Bias
- Conformity
- In-group bias
- Institutional bias
- self-serving bias

2.8 References

- [1] Lowenthal, Mark M. (2000). *Intelligence: From Secrets to Policy*. Washington, D.C.: CQ Press. p. 49. ISBN 1-56802-512-2.
- [2] Lowenthal, Mark M. *Intelligence: From Secrets to Policy*. CQ Press. Washington, D.C. 2000. 42-43. ISBN 1-56802-512-2
- [3] Gulf Link. “A Guide to Intelligence” . Retrieved 2008-04-26.
- [4] “The 9/11 Commission Report” (PDF) (Press release). National Commission on Terrorist Attacks Upon the United States. 2004-07-22. Retrieved 2008-04-27.
- [5] Federation of American Scientists. “SIGINT Overview” . Retrieved 2008-04-26.
- [6] Lowenthal, Mark M. (2000). *Intelligence: From Secrets to Policy*. Washington, D.C.: CQ Press. p. 65. ISBN 1-56802-512-2.
- [7] Goebel, Greg. “Frontiers In Cryptology” . Retrieved 2008-04-26.
- [8] Patterson, Tom; N. Kelso (2004). “Hal Shelton Revisited: Designing and Producing Natural-Color Maps with Satellite Land Cover Data” . Journal of the North American Cartographic Information Society. Retrieved 2008-04-26.
- [9] Best Jr., Richard A.; Cumming, A. (2007-12-05). “Open Source Intelligence (OSINT): Issues for Congress” (PDF). Retrieved 2008-04-26..
- [10] Federation of American Scientists. “Measurement and Signals Intelligence” . Retrieved 2008-04-26.
- [11] David L. Carter PhD. (2004). “Law Enforcement Intelligence: A Guide for State, Local, and Tribal Law Enforcement Agencies” (PDF). Retrieved 2008-04-27.
- [12] “The Commission on the Intelligence Capabilities the United States Regarding Weapons of Mass Destruction” (PDF) (Press release). The Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction. 2005-03-31. Archived from the original (PDF) on 2008-05-11. Retrieved 2008-04-28. line feed character in |publisher= at position 22 (help)
- [13] Heuer Jr., Richards J (1999). *Psychology of Intelligence Analysis*. Berlin: Center for the Study of Intelligence. p. 111. doi:10.1007/b62130. ISBN 1-929667-00-0.

Chapter 3

Job's tears

Job's tears (US) or **Job's-tears** (UK), ^[1] scientific name *Coix lacryma-jobi*, also known as **coixseed**, **tear grass**, **hato mugi**, **adlay** or **adlai**, is a tall grain-bearing perennial **tropical plant** of the family **Poaceae** (grass family). It is native to **Southeast Asia** ^[2] but elsewhere is cultivated in gardens as an **annual**. It has been naturalized in the southern **United States** and the **New World** tropics. In its native environment it is grown in higher areas where rice and corn do not grow well. Job's tears are also commonly sold as **Chinese pearl barley** in **Asian supermarkets**, although *C. lacryma-jobi* is not closely related to **barley** (*Hordeum vulgare*).

There are two main varieties of the species, one wild and one cultivated. The wild variety, *Coix lacryma-jobi* var. *lacryma-jobi*, has hard-shelled pseudocarps—very hard, pearly white, oval structures used as beads for making rosaries, necklaces, and other objects. The cultivated variety *Coix lacryma-jobi* var. *ma-yuen* is harvested as a cereal crop, has a soft shell, and is used medicinally in parts of Asia. ^[3]

3.1 Taxonomy

The species was named by **Carl Linnaeus** in 1753 with the epithet as a Latin translation of the metaphorical *tear of Job*. As of February 2015, four varieties are accepted by the **World Checklist of Selected Plant Families**: ^[4]

- *Coix lacryma-jobi* var. *lacryma-jobi*. Widely distributed throughout the Asian subcontinent to peninsular Malaysia and Taiwan; naturalized elsewhere.
- *Coix lacryma-jobi* var. *ma-yuen* (Rom.Caill.) Stapf. South China to peninsular Malaysia and the Philippines.
- *Coix lacryma-jobi* var. *puellarum* (Balansa) A.Camus. Assam to Yunnan (China) and Indochina.
- *Coix lacryma-jobi* var. *stenocarpa* Oliv.. Eastern Himalayas to Indochina.

3.2 Uses



C. lacryma-jobi plant with flowers and fruit in Nepal



yulmu grains



yulmucha (yulmu tea)

Besides the use for ornamental purposes, Job's tears grains are useful as a source of food (cereals) and folk medicine.* [5]* [6]

Throughout East Asia, Job's tears are available in dried form and cooked as a grain. The grains are generally spherical, with a groove on one end, and polished white in color, though in Japan unpolished *yuuki hatomugi*, which is unpolished and brown in color, is also available.

In Korea, a thick drink called *yulmu cha* (율무차, literally “Job's tears tea”) is made from powdered Job's tears. A similar drink, called *Yi Ren Jiang* (薏仁漿), also appears in Chinese cuisine, and is made by simmering whole polished Job's tears in water and sweetening the resulting thin, cloudy liquid with sugar. The grains are usually strained from the liquid but may also be consumed separately or together.

In both Korea and China, distilled liquors are also made from the grain. One such example is the South Korean liquor called *okroju* (오크주; hanja: 玉露酒), which is made from rice and Job's tears. An ancient Chinese beer recipe included the grain as an ingredient.* [7] In Japan, an aged vinegar is made from the grain.* [8]

In southern Vietnam, a sweet, cold soup called *sâm bồ lương* has Job's Tears as one of its ingredients. This dish derives from the southern Chinese *tong sui* called *qīng bǔ liáng* (清補涼; Cantonese: ching1 bou2 leung4).

In Thailand, it is often consumed in teas and other drinks, such as soy milk.

It is also used alongside other herbs in traditional Chinese medicine. Particularly *Coix lacryma-jobi* var. *ma-yuen* has been used in the traditional Chinese medicine to invigorate the spleen function and promote urination, alleviate arthritis, arrest diarrhea, remove heat and facilitate the drainage of pus.* [9]


In both the Eastern Band of Cherokee Indians and the Cherokee Nation in Oklahoma, the beads of Job's Tears are called “corn beads” or “Cherokee corn beads” and have been used for personal adornment since at least the time of the united Cherokee Republic. A common folk story is that the corn beads sprang up along the path during the 1838 forced march of many Cherokees to Oklahoma from their southeastern North American homelands by the U.S. military.



C. lacryma-jobi seeds in a necklace prepared in the Zulu tradition

3.3 References

- [1] “BSBI List 2007” . Botanical Society of Britain and Ireland. Archived from the original (xls) on 2015-01-25. Retrieved 2014-10-17.
- [2] Taylor, G.D. (Autumn 1953). “Some crop distributions by tribes in upland Southeast Asia” . *Southwestern Journal of Anthropology*. University of New Mexico. 9 (3): 296–308. doi:10.1086/soutjanth.9.3.3628701. JSTOR 3628701.

- [3] Arora, R.K. (1977). "Job's tears (*Coix lacryma-jobi*) - a minor food and fodder crop of northeastern India" . *Economic Botany*. **31** (3): 358–366. doi:10.1007/bf02866887.
- [4] "Search for *Coix lacryma-jobi*". *World Checklist of Selected Plant Families*. Royal Botanic Gardens, Kew. Retrieved 2015-02-01.
- [5] Hill A.F. (1952). *Economic Botany*. McGraw-Hill.
- [6] Duke J.A. (1983). *Handbook of Energy Crops*.
- [7] "Revealing a 5,000-u old beer recipe in China" . *National Academy of Sciences of the United States of America*. **113**: 6444–6448. doi:10.1073/pnas.1601465113. Retrieved 2016-06-03.
- [8] "Traditional Japanese foods - Hato Mugi Vinegar" . Natural Import Company. Retrieved 2012-01-10.
- [9] Wang L, Waltenberger B, Pferschy-Wenzig EM, Blunder M, Liu X, Malainer C, Blazevic T, Schwaiger S, Rollinger JM, Heiss EH, Schuster D, Kopp B, Bauer R, Stuppner H, Dirsch VM, Atanasov AG (29 July 2014). "Natural product agonists of peroxisome proliferator-activated receptor gamma (PPAR γ): a review" . *Biochem Pharmacol*. **92**: 73–89. doi:10.1016/j.bcp.2014.07.018. PMC 4212005 . PMID 25083916.

3.4 Further reading

- *Flora of China*, Vol. 22, pp. 648–649, Online
- Pink, A. (2004). *Gardening for the Million*. Project Gutenberg Literary Archive Foundation.

3.5 External links

- Job's Tears
- Sorting Coix names

Chapter 4

John Titor

John Titor is the name used on several **bulletin boards** during 2000 and 2001 by a poster claiming to be a military **time traveler** from 2036. ^[1] ^[2] Titor made numerous vague and specific predictions regarding calamitous events in 2004 and beyond, attracting world-wide attention during the ensuing decade. ^[3] His descriptions of the aftermath of a nuclear war, including the devastation of numerous countries around the world, a breakup of the United States into five smaller sovereignties, and general destruction of the global environment and infrastructure inspired fiction and music, and triggered investigations by journalists and others.

Subsequent closer examination of Titor's assertions provoked widespread skepticism. Inconsistencies in his explanations, the uniform inaccuracy of his predictions, and a private investigator's findings all led to the general impression that the entire episode was an elaborate **hoax**. A 2009 investigation concluded that Titor was likely the creation of Larry Haber, a Florida entertainment lawyer, along with his brother John, a computer scientist. ^[4]

4.1 Titor's posts

The first posts using John Titor's military symbol appeared on the *Time Travel Institute* forums on November 2, 2000, under the name *TimeTravel_0*. ^[5] At that time the name “John Titor” was not being used. The posts discussed time travel in general, the first one being the “six parts” description of what a time machine would need to have to work (see below) and responses to questions about how such a machine would work. Early messages tended to be short.

The name “John Titor” was not introduced until January 2001, when *TimeTravel_0* began posting at the **Art Bell BBS Forums** (which required a name or **pseudonym** for every account). The Titor posts ended in late March 2001.

Around 2003, various websites reproduced Titor's posts, re-arranging them into narratives. Not all refer to the original dates posted. ^[6]

4.1.1 Outline

In his online postings, Titor claimed to be an American soldier from 2036, based in **Tampa, Florida**. He was assigned to a governmental time-travel project, and sent back to 1975 to retrieve an **IBM 5100** computer which he said was needed to **debug** various legacy computer programs in 2036; a possible reference to the **UNIX year 2038 problem**. The IBM 5100 runs the **APL** and **BASIC** programming languages.

Titor had been selected for this mission specifically, given that his paternal grandfather was directly involved with the assembly and programming of the 5100. Titor claimed to be on a stopover in the year 2000 for “personal reasons,” to collect pictures lost in the (future) civil war and to visit his family, of whom he spoke often.

Titor also said he had been, for a few months, trying to alert anyone that would listen about the threat of **Creutzfeldt–Jakob disease** spread through beef products and about the possibility of civil war within the United States. When questioned about them by an online subscriber, Titor also expressed an interest in mysteries such as **UFOs**, which remained unexplained in his time. Titor suggested that **UFOs** and **extraterrestrials** might be travelers from much further into the future than his own time, with superior time machines.

4.1.2 Time machine

Titor described his time machine on several occasions. In an early post, he described it as a “stationary mass, temporal displacement unit powered by two top-spin, dual positive singularities”, producing a “standard off-set Tipler sinusoid”.

The earliest post was more explicit, saying it contained the following:

- Two magnetic housing units for the dual micro singularities
- An electron injection manifold to alter mass and gravity of the micro singularities
- A cooling and X-ray venting system
- Gravity sensors, or a variable gravity lock
- Four main cesium clocks
- Three main computer units

According to the posts, the device was installed in the rear of a 1967 Chevrolet Corvette convertible and later moved to a 1987 truck having four-wheel drive.

Titor shared several scans of the manual of a “C204 Time Displacement Unit” with diagrams and schematics, and posted some photographs of the device installed in the car.*[7]

Titor claimed that the “Everett–Wheeler model of quantum physics,” better known as the many-worlds interpretation, was correct. The model posits that every possible outcome of a quantum decision occurs in a separate “universe.” Titor stated that this was the reason the grandfather paradox would not happen; following the logic of the argument, Titor would be killing a different John Titor's grandfather in a timeline other than his own.

...The grandfather paradox is impossible.

In fact, all paradox is impossible. The Everett–Wheeler–Graham or multiple world theory is correct.

All possible quantum states, events, possibilities, and outcomes are real, eventual, and occurring.

The chances of everything happening someplace at sometime in the superverse are 100%.*[8]

4.1.3 Predictions

Although invoking the many-worlds interpretation of quantum mechanics, whereby events from his timeline may differ from our own, Titor also expressed assurance that the differences were minimal. As such, his descriptions have been interpreted as predictions and compared with historical events since 2001.

The most immediate of Titor's predictions was of an upcoming civil war in the United States having to do with “order and rights”.*[9] He described it as beginning in 2004,*[10] with civil unrest surrounding the presidential election of that year. This civil conflict that he characterized as “having a Waco type event every month that steadily gets worse”*[10] would be “pretty much at everyone's doorstep”*[9] and erupt by 2008.

As a result of the war, the United States would split into five regions based on various factors and differing military objectives. This civil war, according to Titor, would end in 2015 with a brief but intense World War III.

Titor refers to the exchange as “N Day”. Washington, D.C. and Jacksonville, Florida are specifically mentioned as being hit. After the war, Omaha, Nebraska would be the new U.S. capital. Titor was vague as to the exact motivations and causes for World War III. At one point, he characterized the hostilities as being led by “border clashes and overpopulation”.*[11] He also pointed to contemporary conflict between Arabs and Israel as not a cause, but rather a milestone that precedes a World War III.

Titor claimed that as a 13-year-old in 2011, he joined the Fighting Diamondbacks, a shotgun infantry unit in Florida, for at least four years. In other posts, he described himself as hiding from the war.

4.2 Criticism and discussion

As Titor brought significant attention, there also emerged analysis and discussion concerning the veracity of his claims about his origins and mission, and the future events he talked about. No John Titor or Titor family is known to exist, meaning that who posted as Titor used a pseudonym. The story has been called inconsistent as contradictions between statements at different times have been observed. Holding the **many-worlds interpretation** as correct, Titor claimed that his mission as a time traveler was to shape a timeline in which many chaotic events of his time, including World War III and the civil war in the US, never happened. In some supposed Titor's appearances in the internet and other media segments prior to his main posts (notably in faxes to the radio talk show *Coast to Coast AM* in 1998), he stated that he was not able to change the future despite his efforts, suggesting one of the possible contradictions. Nevertheless, none of the specific events he predicted to a near future, chaotic or not, have come to happen (see below).

Some issues with the technology have also been considered. In one of Titor's pictures of a supposed time machine, a laser beam is seen allegedly being bent by gravitational distortion, but the view of nearby objects is not distorted as would be expected. Also, Titor knew about technical features of the IBM 5100 which were not available to the public at the time, albeit widely commented in the industry, suggesting he had some advanced understanding of the machine or computers in general.

4.2.1 Predictive failures

One of Titor's earliest assertions was that **CERN** would discover the basis for time travel sometime around 2001, with the creation of miniature black holes about half a year after his departure. This did not occur.*[12][13] An article published around the time he had predicted about miniature **black holes** created by CERN (a recurring theme, also ascribed to **Fermilab** and **Brookhaven** at various times)*[14] was taken by some to be evidence of this claim, but these events did not occur either.*[15][16]

Civil war did not break out after the 2004 presidential election,*[17] nor did conflicts or military involvement in 2012.*[18]

Titor unambiguously claimed that the last **Olympics** would occur in 2004. While it is unclear if he meant the summer or winter Olympics, both have occurred since this time.*[19]

However, because Titor asserted that the many-worlds interpretation was proved correct by his time, his predictions could refer to another **timeline** and not ours, making them **unfalsifiable**.*[20] This led to different interpretations, including that he had effectively accomplished his mission by creating another timeline (despite his supposed previous statements that it would be too difficult), or that he inadvertently traveled to a different timeline (ours) and mistook it as his own, or that all time travel is pointless if the chaotic timeline would not cease to exist.

4.2.2 Story and consistency

Potential contradictions have been observed in different Titor's posts. In some of the posts, he claims that he was homeschooled, while in others he states that his basic education was conducted in the University of Florida. Similarly, he stated that he hid himself during the civil war in the U.S., while also stating in other instances that he fought in the war. In some posts, he claims that money is widely used and people still have **credit cards**, despite his statement that centralized banking no longer exists (this is either an inconsistency or implies the rise of **private currencies**).

Titor's story could also have been inspired by science fiction works. The use of an automobile as a time machine, for example, had been a key plot device in the popular 1985 movie *Back to the Future* and its sequels (as the **DeLorean sports car**), among others. Additionally, commentators have pointed out similarities between the Titor story and Pat Frank's classic post-apocalyptic science fiction novel *Alas, Babylon*.*[21] Among other similarities, *Alas, Babylon* takes place in a small river-side town in Florida just before and after a nuclear war and describes the struggle to survive as a family in the aftermath. In the book, the protagonist lives in the fictional town of "Fort Repose", while Titor claimed to live in the "Fort", formerly the **University of Florida**. The prediction of tiny black holes as a result of time travel (specifically, the sending back of information) is a key plot point from the 1980 novel *Thrice Upon A Time* by James P. Hogan.

Some suggested that, yet in the summer of 1998 prior to his posts, Titor sent two faxes to Art Bell's radio program *Coast to Coast AM*, stating that "Y2K is a disaster. Many people freeze to death trying to get to warmer weather. The gov. tries to keep power by instituting **martial law**..."*[22] referring to popular legends of the time about the

Y2K bug.

In the online story, Titor stated that a part of his mission was to prevent the coming world war by changing history. Yet some claimed that during an IRC chat in October 2000, a month before he began posting, Titor was asked if the future could be changed from his predictions, and answered “It’s too late ...I just wish things didn’t have to happen the way they will.”

4.2.3 Technology

Titor provided an image of a detail of a supposed time machine, with a **laser pointer** beam “being bent by the gravitational field produced outside the vehicle by the distortion unit”. The beam being “bent” reveals an inconsistency of objects near the beam not appearing to be bent as well: the framing of the window visible in the background, for instance, should appear distorted in proximity to a large gravity **gradient**, but it does not. Some have speculated the “beam” is an **optical fiber**.*[23]

Titor claimed that he was sent back to obtain an **IBM 5100** because it could translate several types of computer code. According to IBM engineer Bob Dubke, Titor’s statements regarding the IBM 5100’s little-known ability to **emulate** and debug mainframe systems were correct.*[24] Supporters state that this information was not publicly available in 2000 or 2001 when Titor made his declaration,*[25] and Titor himself stated that this feature was “discovered” as late as 2036 when **Unix**, as the underlying source behind all computer operating systems still running local infrastructures and other computational tasks, was only **two years away from no longer functioning** due to 32-bit integer limitations.*[26] However, this emulation capability was widely known in the industry and commented on in depth in numerous publications dealing with both the 5100 and programmable **microcode** in general.*[27] References to this were also available on the Internet as early as 1999 and therefore predated Titor’s postings.*[28]

4.3 Investigations

An Italian television program, *Voyager – Ai confini della conoscenza*, aired the results of an investigation of John Titor on May 19, 2008. Private investigator Mike Lynch found no registry evidence, past or present, of any individual named John Titor. He did, however, identify the John Titor Foundation, a for-profit company formed on September 16, 2003, with no office or address other than a rented post box in **Kissimmee, Florida**. An IP address connected with Titor also geolocated to Kissimmee.*[29]

In 2009, a report by John Hughston of the Hoax Hunter website named Larry Haber, a Florida entertainment lawyer, as the CEO of the foundation.*[30] Lynch concluded that Haber and his brother John Rick Haber, a computer scientist, were very likely the men behind John Titor, whom they actually introduced in 1998, accompanied by different predictions, including chaos due to the Y2K “bug” .*[4] John Hughston also reported that John Titor is a registered trademark with the United States Patent and Trademark office.

4.4 In popular culture

- In 2003, the John Titor Foundation published a book, *John Titor: A Time Traveler’s Tale* (ISBN 1-59196-436-9), discussing his claims; the book is now out of print.
- In 2004, *Time Traveler Zero*, a play based on the John Titor story, was staged in the United States.*[31]
- The 2009 visual novel *Steins;Gate*, which was adapted into an anime in 2011, is centered on John Titor and his theories. A civil war caused by SERN (the fictional version of CERN), due to their discovery of time travel, is covered as well.*[32]

4.5 References

[1] “The John Titor Story” . *johnntitor.com*.

[2] Scott, Alwyn (26 Sep 2007). *The nonlinear universe: chaos, emergence, life*. Springer. p. 121. ISBN 978-3-540-34152-9.

- [3] Karl Simanonok (2003-05-19). “John Titor Validity Test Based on Prediction of Civil War by 2004–2005” . Johntitor.strategicbrains.com. Retrieved 2010-09-01.
- [4] Who was John Titor, the time traveller who came from 2036 to warn us of a nuclear war? *Telegraph.co*, retrieved April 22, 2016.
- [5] The original John Titor thread
- [6] “John Titor – Time Traveler” . Retrieved 2007-03-15.
- [7] johntitor.strategicbrains.com
- [8] John Titor, 2/2/01 10:09
- [9] John Titor, 2/27/01 17:25
- [10] John Titor, 2/1/01 8:36
- [11] John Titor, 2/8/01 9:40
- [12] “The safety of the LHC” . CERN press office. Retrieved 2015-07-05.
- [13] “Earth Is Safe: No Black Holes Spun Out of Atom Smasher, Yet” . Live Science. Retrieved 2015-07-05.
- [14] A Black Hole Ate My Planet, mentions one widely reported article in *The Sunday Times*
- [15] “Fermilab Today” . FNAL. Retrieved 2015-07-05.
- [16] “RHIC - Black Holes?”. Brookhaven National Laboratory. Retrieved 2015-07-06.
- [17] “History Guy: Wars of 2004” . Historyguy.com. Retrieved 2015-07-05.
- [18] “World Map of All Wars and Conflicts Happening In 2012” . Gizmodo. Retrieved 2015-07-06.
- [19] “Olympic Games - Official Site” . Olympic.org. Archived from the original on 2015-07-05. Retrieved 2015-07-05.
- [20] “Many-Worlds Interpretation of Quantum Mechanics” . Stanford.edu. Retrieved 2015-07-06.
- [21] TAN, What to ask next time, #14894 Archived September 27, 2007, at the Wayback Machine.
- [22] “John Titor faxes to Art Bell” , *The Anomalies Network*, 29 October 2007, retrieved from archive of 23 July 2011
- [23] “John Titor: Hoax” . 2004-06-26. Retrieved 2007-03-15.
- [24] “Time traveller most likely to be spotted in Rochester, IBM 5100 Engineer Bob Dubke on hidden features” . *Rochester Magazine*. Archived from the original on 2005-12-10. Retrieved 2007-03-15.
- [25] “News about the 5100 Computer” . 2005. Retrieved March 15, 2007.
- [26] John Titor, 12/30/00 13:37
- [27] “The IBM Family of APL Systems” . *IBM Systems Journal*. IBM. **30** (4). 1991. doi:10.1147/sj.304.0416.
- [28] “John Titor's Story” . Archived from the original on 2007-03-04. Retrieved 2007-03-15.
- [29] “Rai.it – Voyager – Ai confini della conoscenza” . Voyager. Archived from the original on 2011-07-22. Retrieved 2010-09-01.
- [30] John Titor Razimus Report. Hoax Hunter, retrieved April 22, 2016.
- [31] Time Traveler Zero Zero
- [32] Video game Steins;Gate is now an anime. *Japanator*. Retrieved on March 03, 2017

4.6 External links

- John Titor: a Time Traveller From The Year 2036?
- Is John Titor an upcoming Disney franchise?
- John Titor Archive: Interview with a time traveler
- The original John Titor thread on Time Travel Institute

Chapter 5

Juvenilia

This article is about the literary term. For other uses, see [Juvenilia \(disambiguation\)](#).
Not to be confused with [Juvenalia](#).

Juvenilia are literary,^{*}[\[1\]](#) musical or artistic works produced by an author during their youth. Written juvenilia, if published at all, usually appear as a retrospective publication, some time after the author has become well known for later works.

The term was first recorded in 1622 in [George Wither](#)'s poetry collection *Ivvenilia*. Later, other notable poets, such as [John Dryden](#) and [Alfred Lord Tennyson](#), came to use the term for collections of their early poetry. [Jane Austen](#)'s literary works are also titled *Juvenilia*.

Exceptions to retrospective publication include [Leigh Hunt](#)'s collection *Juvenilia*, first published when he was still in his teens; and [Lord Byron](#)'s publication of *Fugitive Pieces* when the author was only 17 years old, and his subsequent publication of *Hours of Idleness* at the age of 18. In these early pieces, Byron explores many of the themes that would shape his later works.

5.1 References

- [1] [Kathryn Sutherland](#). “[Discovering Literature: Romantics and Victorians - Jane Austen's juvenilia](#)” . British Library. Retrieved 12 October 2014.

Chapter 6

Kinetic bombardment

“Project Thor” redirects here. For other uses, see [Thor \(disambiguation\)](#).

“Kinetic strike” redirects here. For the political euphemism, see [kinetic military action](#).

For the generic concept of attacking a planetary surface from orbit, see [Orbital bombardment](#).

A **kinetic bombardment** or a **kinetic orbital strike** is the hypothetical act of attacking a planetary surface with an inert [projectile](#), where the destructive force comes from the [kinetic energy](#) of the projectile impacting at very high velocities. The concept originated during the [Cold War](#).

The typical depiction of the tactic is of a [satellite](#) containing a magazine of [tungsten](#) rods and a directional [thrust](#) system. When a strike is ordered, the satellite would [brake](#)^[1] one of the rods out of its orbit and into a [suborbital](#) trajectory that intersects the target. As the rod approaches [periapsis](#) and the target due to gravity, it picks up immense speed until it begins decelerating in the atmosphere and reaches [terminal velocity](#) shortly before impact. The rods would typically be shaped to minimize [air resistance](#) and maximize terminal velocity. In science fiction, the weapon is often depicted as being launched from a [spaceship](#), instead of a satellite.

Kinetic bombardment has the advantage of being able to deliver projectiles from a very high angle at a very high speed, making them extremely difficult to defend against. In addition, projectiles would not require explosive warheads, and—in the simplest designs—would consist entirely of solid metal rods, giving rise to the common nickname “Rods from God”.^[2] Disadvantages include the technical difficulties of ensuring accuracy and the prohibitively high costs of positioning ammunition in orbit.

The [Outer Space Treaty](#) is designed to prohibit weapons of mass destruction in orbit or outer space; however, its text only prohibits nuclear, biological, and chemical weapons. Since the most common form of kinetic ammunition is inert tungsten rods, in most cases, kinetic bombardment is not prohibited by the treaty.

6.1 Real life concepts and theories

During the Vietnam War, there was limited use of the [Lazy Dog](#) bomb, a steel projectile shaped like a conventional bomb but only about 1” long and 3/8” diameter. A piece of sheet metal was folded to make the fins and welded to the rear of the projectile. These were dumped from aircraft onto enemy troops and had the same effect as a machine gun fired vertically.^[3]^[4] Observers visiting a battlefield after an attack said it looked like the ground had been 'tenderized' using a gigantic fork. Bodies had been penetrated longitudinally from shoulder to lower abdomen. This idea is similar to the concept of bullets not being fired out of a weapon, but having enough velocity to impact a human body with enough force to kill.

Project Thor is an idea for a weapons system that launches [telephone pole](#)-sized kinetic [projectiles](#) made from [tungsten](#) from Earth's orbit to damage targets on the ground. [Jerry Pournelle](#) originated the concept while working in operations research at Boeing in the 1950s before becoming a science-fiction writer.^[5]^[6]

The system most often described is “an orbiting [tungsten telephone pole](#) with small fins and a computer in the back for guidance”. The system described in the 2003 [United States Air Force](#) report was that of 20-foot-long (6.1 m), 1-foot-diameter (0.30 m) tungsten rods, that are satellite controlled, and have global strike capability, with impact speeds of [Mach 10](#).^[7]^[8]^[9]

The time between deorbit and impact would only be a few minutes, and depending on the orbits and positions in the orbits, the system would have a world-wide range. There would be no need to deploy missiles, aircraft or other vehicles. Although the **SALT II** (1979) prohibited the deployment of orbital **weapons of mass destruction**, it did not prohibit the deployment of **conventional weapons**. The system is not prohibited by either the **Outer Space Treaty** or the **Anti-Ballistic Missile Treaty**.^[8]^[10]

The idea is that the weapon would naturally contain a large kinetic energy, because it moves at **orbital** velocities, at least 8 kilometers per second. As the rod would approach Earth it would necessarily lose most of the velocity, but the remaining energy would cause considerable damage. Some systems are quoted as having the yield of a small tactical nuclear bomb.^[9] These designs are envisioned as a **bunker buster**.^[8]^[11] As the name suggests, the 'bunker buster' is powerful enough to destroy a nuclear bunker. With 6–8 satellites on a given orbit, a target could be hit within 12–15 minutes from any given time, less than half the time taken by an **ICBM** and without the launch warning. Such a system could also be equipped with sensors to detect incoming **anti-ballistic missile**-type threats and relatively light protective measures to use against them (e.g. Hit-To-Kill Missiles or megawatt-class **chemical laser**).

In the case of the system mentioned in the 2003 Air Force report above, a 6.1 m × 0.3 m tungsten cylinder impacting at Mach 10 has a kinetic energy equivalent to approximately 11.5 tons of TNT (or 7.2 tons of dynamite). The mass of such a cylinder is itself greater than 9 tons, so the practical applications of such a system are limited to those situations where its other characteristics provide a clear and decisive advantage—a conventional bomb/warhead of similar weight to the tungsten rod, delivered by conventional means, provides similar destructive capability and is far more practical and cost effective.

The highly elongated shape and high mass are to enhance sectional density and therefore minimize kinetic energy loss due to air friction and maximize penetration of hard or buried targets. The larger device is expected to be quite good at penetrating deeply buried bunkers and other command and control targets.^[12]

The weapon would be very hard to defend against. It has a very high closing velocity and small radar cross-section. Launch is difficult to detect. Any **infrared** launch signature occurs in orbit, at no fixed position. The infrared launch signature also has a much smaller magnitude compared to a ballistic missile launch. One drawback of the system is that the weapon's sensors would almost certainly be blind during **atmospheric reentry** due to the **plasma sheath** that would develop ahead of it, so a mobile target could be difficult to hit if it performed an unexpected maneuver. The system would also have to cope with atmospheric heating from re-entry, which could melt non-tungsten components of the weapon.^[13]

The phrase “Rods from God” is also used to describe the same concept.^[14] An Air Force report called them “hypervelocity rod bundles”.^[2]

6.2 In science fiction

See also: **Relativistic kill vehicle**

In the mid-1960s, popular science interest in orbital mechanics led to a number of science fiction stories which explored their implications. Among these was *The Moon Is a Harsh Mistress* by **Robert A. Heinlein** in which the citizens of the Moon bombard the Earth with rocks wrapped in iron containers which are in turn fired from an **electromagnetic launch system** at Earth-based targets.

In the 1970s and 1980s this idea was refined in science fiction novels such as *Footfall* by **Larry Niven** and **Jerry Pournelle** (the same Pournelle that first proposed the idea for military use in a non-fiction context), in which aliens use a Thor-type system. During the 1980s and 1990s references to such weapons became a staple of science fiction roleplaying games such as *Traveller*, *Shadowrun* and *Heavy Gear* (the latter game naming these weapons *ortillery*, a portmanteau of *orbital artillery*), as well as visual media including *Babylon 5's* “mass drivers” and the film *Starship Troopers*, itself an adaptation of a Heinlein novel of the same name.

The re-purposing of space colonies for use in kinetic bombardment (referred as a “colony drop”) is a frequent element of the *Gundam* franchise and is central to the plots of *Mobile Suit Gundam: Char's Counterattack* and *Mobile Suit Gundam 0083: Stardust Memory*.

A smaller “crowbar” variant is mentioned in *David's Sling* by **Marc Stiegler** (Baen, 1988). Set in the Cold War, the story is based on the use of (relatively inexpensive) information-based “intelligent” systems to overcome an enemy's numerical advantage. The orbital kinetic bombardment system is used first to destroy the Soviet tank armies that have invaded Europe and then to take out Soviet ICBM silos prior to a nuclear strike.

In Neal Stephenson's *Anathem* a kinetic bombardment weapon is deployed from orbit to trigger the eruption of a dormant volcano.

From the mid-1990s, kinetic weapons as science fiction plot devices appeared in video games. Appearing in Bullfrog Productions' 1996 *Syndicate Wars* as a player-usable weapon, it also featured prominently in the plot of *Tom Clancy's Endwar*, *Mass Effect 2* and *Call of Duty: Ghosts*, to name some.

The Warren Ellis comic *Global Frequency* (issue #12, “Harpoon” , August 2004) featured the threat of kinetic spears, weapons designed to be dropped from satellites, heat up on re-entry, and strike the ground with the force of a tactical nuke, and as hot as the edge of the sun. Rather than being a weapon of war they were depicted as part of a 'die-back' protocol designed to reduce Earth's human population to a sustainable level.

In Daniel Suarez's book *Freedom*, a suborbital version of Thor is used composed of many small arrows or spikes for anti-personnel use.

In James S. A. Corey's *The Expanse* series, a radical group from within the Belter movement bombards Earth with high-speed asteroids, killing billions.

In 2013 a kinetic weapon bombardment system consisting of tungsten rods in an orbiting platform, codenamed Project: Zeus, was featured in the movie *G.I. Joe: Retaliation*, where it destroys London. However, the movie misrepresented physics by claiming the rod would not be “launched” or “fired” but merely “dropped” . If it were released without force it would orbit the Earth in the same manner as the platform itself. In order for a rod to fall straight toward the center of Earth it would need to be launched away from the station with a *tangential velocity* equal in magnitude and opposite in direction from the orbiting station. This velocity would be in the range of approximately 7–8 km/s for satellites in *low earth orbit*.

In John Birmingham's *Stalin's Hammer* (a part of his *Axis of Time* series), Soviet scientists use 21st century technology obtained from a fleet thrown back to World War II to create a satellite capable of launching tungsten rods from orbit and launch it in early 50's.

6.3 See also

- Kinetic energy penetrator
- Prompt Global Strike
- Railgun (ground/navy, mach 10)
- Relativistic kill vehicle
- Brilliant Pebbles
- Flechette
- Fractional Orbital Bombardment System

6.4 References

- [1] <https://books.google.com/books?id=pjiuMbDxsJIC&pg=PA107&lpg=PA107&dq=%22brake+out+of+orbit%22&source=bl&ots=Uo1gpLSLUA&sig=XFpLYY9iJuA6yNSQZee8Tr0C0RE&hl=en&sa=X&ved=0CCEQ6AEwAGoVChMIImvqnjfqWxwIVyx0-Ch2v=onepage&q=%22brake%20out%20of%20orbit%22&f=false> - The use of the word “brake” in this paragraph refers to the act of braking; the fact that by slowing the rod's orbital trajectory, the satellite can de-orbit it in order to drop it onto the planet below.
- [2] Eric Adams (June 2004). “Rods from God” . *Popular Science*. Retrieved 27 May 2010.
- [3] David Karmes (2014). *The Patricia Lynn Project: Vietnam War, the Early Years of Air Intelligence*. iUniverse. The Lazy Dog Bomb. ISBN 978-1-4917-5228-9.
- [4] Ralph A Rowley (12 April 2013). *Close Air Support In Vietnam*. Lulu.com. p. 43. ISBN 978-1-939335-12-8.
- [5] Jonathan Shainin (10 December 2006). “Rods From God” . *New York Times*.
- [6] Jerry Pournelle (6 March 2006). “Chaos Manor Mail” . The View from Chaos Manor.

- [7] Giuseppe Anzera (18 August 2005). “Star Wars: Empires strike back” . *Asia Times*. Retrieved 25 May 2010.
- [8] John Arquilla (12 March 2006). “RODS FROM GOD / Imagine a bundle of telephone poles hurtling through space at 7,000 mph” . *San Francisco Chronicle*. Retrieved 25 May 2010.
- [9] Julian Borger (19 May 2005). “Bush likely to back weapons in space” . *The Guardian*. Retrieved 25 May 2010.
- [10] Paul Reynolds (23 January 2007). “China's space challenge to the US” . BBC News. Retrieved 25 May 2010.
- [11] Jack Kelly (28 July 2003). “Rods from God” . *Pittsburgh Post-Gazette*. p. A5.
- [12] History Television, *The Universe*, season 4, episode 8, “Space Wars”; referring to *rod from God*
- [13] Noah Shachtman (20 February 2004). “Pentagon Preps for War in Space” . *Wired*. Retrieved 25 May 2010.
- [14] Michael Goldfarb (8 June 2005). “The Rods from God” . *The Weekly Standard*. Retrieved 28 May 2010.

6.5 Further reading

- *Space Weapons, Earth Wars*, RAND Corporation, 2002, ISBN 0-8330-2937-1

6.6 External links

- “Rods from God” . weeklystandard.com.
- “Rods from God” . Popular Science. June 2004.
- Richard L. Garwin (14 May 2003). “Space Weapons, Not Yet” (PDF).

Chapter 7

KISS principle

“K-I-S-S” redirects here. For other uses, see [Kiss \(disambiguation\)](#).

KISS is an acronym for "**Keep it simple, stupid**" as a design principle noted by the U.S. Navy in 1960.^[1]^[2] The KISS principle states that most systems work best if they are kept simple rather than made complicated; therefore **simplicity** should be a key goal in **design** and unnecessary complexity should be avoided. The phrase has been associated with aircraft engineer **Kelly Johnson** (1910–1990).^[3] The term “KISS principle” was in popular use by 1970.^[4] Variations on the phrase include “Keep it Simple, Silly” , “keep it short and simple” , “keep it simple and straightforward”^[5] and “keep it small and simple” .^[6]

7.1 Origin

The acronym was reportedly coined by **Kelly Johnson**, lead engineer at the **Lockheed Skunk Works** (creators of the **Lockheed U-2** and **SR-71 Blackbird** spy planes, among many others).^[3]

While popular usage has transcribed it for decades as “Keep it simple, stupid” , Johnson transcribed it as “Keep it simple stupid” (no comma), and this reading is still used by many authors.^[7] There was no implicit meaning that an engineer was stupid; just the opposite.^[3]

The principle is best exemplified by the story of Johnson handing a team of design engineers a handful of tools, with the challenge that the jet aircraft they were designing must be repairable by an average mechanic in the field under combat conditions with only these tools. Hence, the “stupid” refers to the relationship between the way things break and the sophistication available to repair them.

The acronym has been used by many in the U.S. military, especially the U.S. Navy and United States Air Force, and the field of **software development**.

7.2 Variants

The principle most likely finds its origins in similar minimalist concepts, such as **Occam's razor**, **Leonardo da Vinci's** “Simplicity is the ultimate sophistication” , **Mies Van Der Rohe's** “Less is more”, **Bjarne Stroustrup's** “Make Simple Tasks Simple!”, or **Antoine de Saint Exupéry's** “It seems that perfection is reached not when there is nothing left to add, but when there is nothing left to take away” . **Colin Chapman**, the founder of **Lotus Cars**, urged his designers to “Simplify, then add lightness” . **Heath Robinson** machines and **Rube Goldberg's** machines, intentionally overly-complex solutions to simple tasks or problems, are humorous examples of “non-KISS” solutions.

An alternative view — “Make everything as simple as possible, but not simpler” —is attributed to **Albert Einstein**, although this may be an editor's paraphrase of a lecture he gave.^[8]

A variant used in marketing is “keep it simple and straightforward” .^[5]

7.3 In film animation

Master animator Richard Williams explains the KISS principle in his book *The Animator's Survival Kit*, and Disney's Nine Old Men write about it in *Disney Animation: The Illusion of Life*, a considerable work of the genre. The problem faced is that inexperienced animators may “over-animate” in their works, that is, a character may move too much and do too much. Williams urges animators to “KISS” .

7.4 In software development

- Chartjunk
- Don't repeat yourself (DRY)
- List of software development philosophies
- Minimalism (computing)
- Reduced instruction set computing
- Rule of least power
- There's more than one way to do it
- Unix philosophy
- Worse is better (Less is more)
- You aren't gonna need it (YAGNI)

7.5 See also

- Muntzing
- Perfect is the enemy of good
- Sturgeon's law
- The Fox and the Cat (fable)
- W. Heath Robinson
- Arch Linux
- Void Linux

7.6 References

This article is based on material taken from the [Free On-line Dictionary of Computing](#) prior to 1 November 2008 and incorporated under the “relicensing” terms of the [GFDL](#), version 1.3 or later.

- [1] *The Routledge Dictionary of Modern American Slang and Unconventional English*, Tom Dalzell, 2009, 1104 pages, p.595, webpage: [BGoogle-5F](#): notes U.S. Navy “Project KISS” of 1960, headed by Rear Admiral Paul D. Stroop, *Chicago Daily Tribune*, p.43, 4 December 1960.
- [2] *The Concise New Partridge Dictionary of Slang*, Eric Partridge, Tom Dalzell, Terry Victor, Psychology Press, 2007, p.384.
- [3] *Clarence Leonard (Kelly) Johnson 1910—1990: A Biographical Memoir* (PDF), by Ben R. Rich, 1995, National Academies Press, Washington, DC, p. 13.
- [4] *Pit & Quarry*, Vol. 63, July 1970, p.172, quote: “as in every other step of the development process, follow the KISS principle — Keep It Simple, Stupid.”

- [5] “Kiss principle definition by MONASH Marketing Dictionary” . 1994-11-18. Retrieved 2016-01-24.
- [6] “Kiss Principle” .
- [7] Ram B. Misra (2004), “Global IT Outsourcing: Metrics for Success of All Parties” , *Journal of Information Technology Cases and Applications*, volume 6 issue 3, page 21. [Online version](#). Retrieved 2009-12-19.
- [8] “Everything Should Be Made as Simple as Possible, But Not Simpler” . [Quote Investigator](#).

7.7 External links

- [Kiss Principle](#)
- [The KISS Principles for ORM Products](#)

Chapter 8

Knock-and-announce

Knock-and-announce, in United States law criminal procedure, is an ancient common law principle, incorporated into the Fourth Amendment,*[1] which requires law enforcement officers to announce their presence and provide residents with an opportunity to open the door prior to a search.

The rule is currently codified in the United States Code,*[2] which governs Fourth Amendment searches conducted by the federal government. Most states have similarly codified the rule into their own statutes,*[3] and remain free to interpret or augment the rule and its consequences in any fashion that remains consistent with Fourth Amendment principles.*[4] A state's knock-and-announce rule will govern searches by state actors pursuant to state-issued warrants, assuming that Federal actors are not extensively involved in the search.

8.1 The rule

English common law has required law enforcement to knock-and-announce since at least *Semayne's case* (1604).*[5] In *Miller v. United States* (1958), the Supreme Court of the United States recognized that police must give notice before making a forced entry and in *Ker v. California* (1963) a divided Court found that this limitation had been extended against the states by the United States Constitution.*[6]

However, in *Wilson v. Arkansas* (1995) the U.S. Supreme Court ruled that a knock-and-announce before entry was a factor that must be considered in reviewing the overall constitutionality of a Fourth Amendment search.*[7] After several state attempts to exclude specific categories (e.g. drug crimes) from the knock-and-announce rule, the Supreme Court in *Richards v. Wisconsin* prohibited the policy, and demanded a return to a case-by-case review scenario.*[8] The *Richards* Court suggested that the knock and announce rule could be dispensed with only in certain circumstances, for example where police have reasonable suspicion that an exigent circumstance exists. The Court read its earlier *Wilson* opinion to suggest that such circumstances might include those:

- which present a threat of physical violence
- where there is “reason to believe that evidence would likely be destroyed if advance notice were given”
- where knocking and announcing would be dangerous or “futile”

The Court expressly stated that whether reasonable suspicion exists depends in no way on whether police must destroy property in order to enter.*[9]

In a similar manner, where officers reasonably believe that exigent circumstances, such as the destruction of evidence or danger to officers will exist, a no-knock warrant may be issued.*[10]*[11] However, despite police awareness that such future exigencies will exist, they are generally not required to seek such a warrant;*[12] in this case, police must have an objectively reasonable belief, at the time of executing the warrant, that such circumstances do in fact exist.*[13]

The Supreme Court has given some guidance as to how long officers must wait after knocking and announcing their presence before entry may be made. In *U.S. v. Banks*,*[14] the Supreme Court found 15 to 20 seconds to be a reasonable time where officers received no response after knocking and where officers feared the home occupant may be destroying the drug evidence targeted by the search warrant. As with most other things in the Fourth

Amendment arena, the Court left reasonableness of the time period to be determined based on the **totality of the circumstances**;*[15] and thus inferior Federal courts have found even shorter time periods to be reasonable.*[16] Some different factors have been propounded by lower courts to guide the analysis of a reasonable wait period.*[17] A few examples are:

- the size, design, and layout of the premises
- the time of day the search is being executed
- the nature of the suspected offense (in particular, does it involve evidence easily destroyed? Is the suspect dangerous?)
- the evidence demonstrating guilt.

Federal courts also recognize that consent may vitiate part or all of the rule. For example, where officers knock, but before announcement are invited in, they no longer need to announce.*[18]

8.2 Effects of the rule

In *Hudson v. Michigan* (2006), the divided Supreme Court ruled that a violation of the knock-and-announce rule does not require the suppression of evidence using the **exclusionary rule**. This is primarily because the goals served by a knock-and-announce policy tend to be lesser than other requirements (such as the warrant requirement) of a valid Fourth-Amendment search: whereas the latter is to protect a reasonable expectation of privacy in a person's body, papers, and effects (among other things), the knock-and-announce rule is designed only to provide a brief moment of privacy for an individual to compose himself before a valid search occurs, to prevent an individual from mistakenly believing that police are common intruders and thus endangering them, and to prevent property damage from a forcible entry.*[19] Because police with probable cause and a valid warrant are already entitled to an entry and search, violation of the simple knock-and-announce rule has not been deemed grave enough in the Federal arena or in most states to justify suppression of the evidence.

Most states have composed their own statutes which require a knock and announcement before making a warranted entry. Because the states are free to offer more liberty to criminal defendants than the Federal constitution demands, the states remain free to impose the exclusionary rule for a violation of the knock-and-announce rule if they so wish. The Supreme Court opinion in *Hudson* is necessarily binding only on those searches conducted by the Federal government.

8.3 See also

- No-knock warrant
- Fourth Amendment to the United States Constitution
- Semayne's case
- Sneak and peek warrant

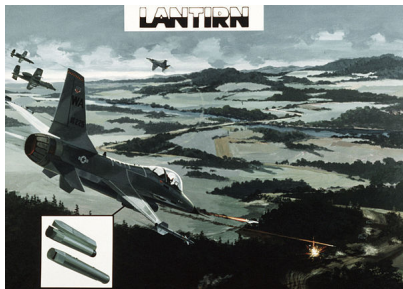
8.4 References

- [1] *Wilson v. Arkansas*, 514 U.S. 927 (1995); *Richards v. Wisconsin*, 520 U.S. 385 (1997)
- [2] 18 U.S.C. § 3109
- [3] See, e.g., *Washington Code Annotated* 10.31.040
- [4] *U.S. v. Scroggins*, 361 F.3rd 1075 (8th Cir. 2004)
- [5] G. Robert Blakey (1964). "The Rule of Announcement and Unlawful Entry: *Miller v. United States* and *Ker v. California*". *University of Pennsylvania Law Review*. **112**: 499. Retrieved 23 March 2017.

- [6] Kevin Sack (19 March 2017). “Door-Busting Raids Leave Trail of Blood - The Heavy Toll of Using SWAT Teams for Search Warrants” . *The New York Times*. p. A1. Retrieved 21 March 2017.
- [7] 514 U.S. 927 (1995)
- [8] 520 U.S. 385 (1997)
- [9] *U.S. v. Ramirez*, 523 U.S. 65 (1998).
- [10] Memorandum Opinion for the Chief Counsel, Drug Enforcement Administration, from Patrick F. Philbin, Deputy Assistant Attorney General for the Office of Legal Counsel, Re: *Authority of Federal Judges and Magistrates to Issue “No-Knock” Warrants*, 26 Op. O.L.C. 44 (June 12, 2002).
- [11] *See, e.g., U.S. v. Segura-Baltazar* 448 F.3d 1281, (11th Cir. 2006)
- [12] *See, e.g., U.S. v. Musa*, 401 F.3d 1208 (10th Cir. 2005)
- [13] *U.S. v. Maden*, 64 F.3d 1505 (10th Cir. 1995)
- [14] 540 U.S. 31 (2003)
- [15] *U.S. v. Jenkins*, 175 F.3d 1208, 1213 (10th Cir. 1999) (stating the Supreme Court has not established a clear cut standard to determine the amount of time officers must wait).
- [16] *See, e.g., U.S. v. Cline*, 349 F.3d 1276 (10th Cir. 2003)
- [17] *U.S. v. Chavez-Miranda*, 306 F.3d 973 (9th Cir. 2002)
- [18] *U.S. v. Hatfield*, 365 F.3d 332 (4th Cir. 2004)
- [19] *U.S. v. Banks*, 282 F.3d 699 (9th Cir. 2002)

Chapter 9

LANTIRN



Artist's concept of a Low Altitude Navigation Targeting Infrared for Night (LANTIRN) scenario for attacking an armored column, 1982



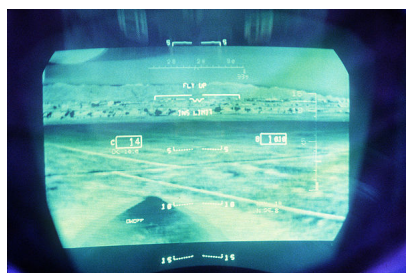
Mounted underneath an F-15E Strike Eagle, the AN/AAQ-13 navigation pod to the left with the AN/AAQ-14 targeting pod to the right. This particular F-15 was assigned to the 366th Fighter Wing (Note the emblem on the intake)

Low Altitude Navigation and Targeting Infrared for Night, or LANTIRN, is a combined navigation and targeting pod system for use on the USAF's premier fighter aircraft —the F-15E Strike Eagle and F-16 Fighting Falcon (Block 40/42 C & D models). LANTIRN significantly increases the combat effectiveness of these aircraft, allowing them to fly at low altitudes, at night and under-the-weather to attack ground targets with a variety of precision-guided weapons.

9.1 Features



AN/AAQ-13 LANTIRN navigation pod aboard an F-15E



F-15E Heads-up display of infrared image from the AN/AAQ-13 LANTIRN navigation pod

LANTIRN consists of a navigation pod and a targeting pod mounted externally beneath the aircraft.

9.1.1 AN/AAQ-13 navigation pod

The **AN/AAQ-13 navigation pod** provides high-speed penetration and precision attack on tactical targets at night and in adverse weather. The navigation pod also contains a **terrain-following radar** and a fixed **thermographic camera**, which provides a visual cue and input to the aircraft's flight control system, enabling it to maintain a pre-selected altitude above the terrain and avoid obstacles. This sensor displays an infrared image of the terrain in front of the aircraft, to the pilot, on a **Head-up display**. The navigation pod enables the pilot to fly along the general contour of the terrain at high speed, using mountains, valleys and the cover of darkness to avoid detection. The pod was the USAF's first wide-field, **forward looking infrared** navigation system for **air superiority fighters**. A downgraded version for export with the terrain-following radar deleted is designated as the AN/AAQ-20 Pathfinder, which is only capable of providing a visual cue/picture of ground features in darkness and adverse weather generated by the infrared sensor, and pilots must rely on his/her own skill to avoid ground obstacles at low altitude flight.

9.1.2 AN/AAQ-14 targeting pod

The **AN/AAQ-14 targeting pod** contains a high-resolution, **forward looking infrared** sensor (which displays an infrared image of the target to the pilot), a **laser designator/rangefinder** for precise delivery of **laser-guided munitions**, a missile boresight correlator for automatic lock-on of the **AGM-65 Maverick** imaging infrared missiles, and software for automatic target tracking. These features simplify the functions of target detection, recognition and attack and permit pilots of single-seat fighters to attack targets with precision-guided weapons on a single pass. A downgraded version for export with the **AGM-65 Maverick** air-to-ground missile compatibility deleted is designated as **AN/AAQ-19 Sharpshooter**.

9.2 Background

The research and development program began in September 1980 with **Martin Marietta Corp.** (now **Lockheed Martin, Inc.**), Orlando, FL, as contractor. Initial operational test and evaluation of the LANTIRN navigation pod was successfully completed in December 1984. The Air Force approved **low-rate initial production** of the navigation pod in March 1985 and full-rate production in November 1986. The first production pod was delivered to the Air Force March 31, 1987. LANTIRN represented a major advance in the U.S. military's ability to carry out operations in darkness and adverse weather, and has been developed further into its successor **AN/AAQ-33 Sniper** pod.

9.3 LANTIRN and the F-14 Tomcat

Until the early 1990s, the **F-14 Tomcat** didn't have clearance to drop bombs even though all Tomcats were built with a **Stores Management System (SMS)** that included air-to-ground options as well as rudimentary software in the **AWG-9**. Early flight clearance work to clear the aircraft for air-to-ground were suspended due to development delays with the F-14 and it being shifted away from the air to ground mission. At the time, the Tomcat was so expensive (and lacked proper defensive **electronic countermeasures (DECM)** and radar homing and warning (**RHAW**) for overland operations) that the Navy did not want to risk it in the air-to-ground role. However, the **TARPS** mission had proven the Tomcat was survivable overland and upgrades to the Tomcat's DECM, expendables and RHAW gear



An F-14D carrying a LANTIRN pod, 2005

were developed to increase its survivability. With the end of the Cold War and de-emphasis on the Fleet Air Defense mission, NAVAIR had renewed flight clearance work before Desert Storm so the F-14 could carry **gravity bombs** as well as **laser-guided bombs** if the target was lased by another jet (first Tomcat LGB drop in combat was made by VF-41 in 1995 during operations over Bosnia with an A-6 **Intruder** providing the requisite target illumination). Meanwhile, the decision had been made by OPNAV to retire the A-6 altogether and allow the F-14 Block 1 Strike variant to take over as the precision strike platform for the air wing. However, the \$1.6B Block 1 Strike program was canceled in budgetary cuts by 1994 with only enough funding to integrate the JDAM, which was years away. In late 1994, an unsolicited proposal from **Martin Marietta** was initiated to demonstrate how a USAF LANTIRN targeting pod could be rapidly integrated onto the Tomcat. This effort was done under the auspices of COMNAVAIRLANT using a fleet aircraft to integrate the digital 1553-based pod on an analog F-14B. In March 1995 a VF-103 fleet aircraft successfully dropped the first laser-guided training rounds (LGTR) and quickly laser-guided bombs (LGB). Due to the early success and interest from Fleet Commanders, NAVAIR began to procure pods and control units for deployment, resulting in VF-103 receiving the first LANTIRN pod June 14, 1996 in time for its upcoming deployment.

The basic LANTIRN was modified into LANTIRN Targeting System (LTS), the navigation pod was removed from the two-pod system and the targeting pod was improved for Tomcat use. The LTS featured a **Global Positioning System** and inertial measurement unit that provided the pod line-of-sight cueing and weapon release ballistics and eliminated the need for external cumbersome and time consuming boresight equipment.

Unlike the early versions, the LTS performed all weapon release calculations and presented release cues that it had generated to the aircrew. The LTS also had a masking avoidance curve display (preventing firing the laser at the jet) and eventually a north orientation curve and 40,000 feet capable laser. The latter became very useful allowing F-14s to employ LGBs above potential threat systems and it came into its own in the higher terrain in **Afghanistan** during **Operation Enduring Freedom**.

The LTS could also generate coordinates for any target located on the FLIR, and a latter software modification, known as T3 (Tomcat Tactical Targeting) increased the accuracy of the coordinates produced by the LTS and allowed generated coordinates for GPS/INS guided weapons (**JDAM**, **JSOW** and **WCMD**). The first combat use of this was during Operation Enduring Freedom when an F-14 generated coordinates for a B-52 that dropped a **CBU-103 WCMD** from over 40,000 feet. These weapons scored hits on a vehicle convoy that had stopped after the first vehicle was destroyed by the Tomcat with LGBs.

The pod also featured an internal computer with ballistics data for the various precision munitions carried by the

F-14. Data is fed to the pod by the Tomcat's **AWG-9** (F-14A and F-14B) and **AN/APG-71** (F-14D) radar, but the LTS in turn only sends video and guidance symbology to the crew's cockpit displays. This means that few wiring and software changes had to be made to the Tomcat in order for it to operate the LTS. All pod controls are in the RIO's cockpit, but the bomb release button is situated with the pilot. The LTS had a price tag of around 3 million US Dollars each and due to these high costs, only 75 were bought for fleet use. Typically, an F-14 squadron brought 6 to 8 pods with them on deployment, which would be permanently fitted to the non-**TARPS** jets.

The first combat use of the LTS was in December 1998 during **Operation Desert Fox** by VF-32.

9.4 General Characteristics

Primary function: Low altitude navigation and targeting infrared for night flying

Contractor: Lockheed Martin, Inc.

Length: Navigation pod, 78.2 in (1.99 m); targeting pod, 98.5 in (2.51 m)

Diameter: Navigation pod, 12 in (305 mm); targeting pod, 15 in (380 mm)

Weight: Navigation pod, 451.1 lb (204.6 kg); targeting pod, 530 lb (240.7 kg)

Aircraft: F-15E, F-16A/B Block 20 (MLU) , F-16C/D Block 40, F-14 B/D, **S-3B**

Sensors: Infrared and terrain following radar sensors on the navigation pod. Infrared and laser designator and ranging sensors on the targeting pod

Introduction Date: March 1987

Unit Cost: Navigation pod, \$1.38 million; targeting pod, \$3.6 million*[1]

9.5 See also

- Targeting pods
- **ATFLIR**
- **LITENING**
- Lockheed Martin Sniper XR
- Thales Damocles
- **PDLCT**

9.6 References

[1] USAF fact sheet: LANTIRN

- Clancy, Tom. *Fighter Wing*. London: HarperCollins, 1995. ISBN 0-00-255527-1.
- Tony Holmes (2005). *US Navy F-14 Tomcat Units of Operation Iraqi Freedom*, Osprey Publishing Limited.
- Erik Hildebrandt (2006). *Anytime, Baby! Hail and Farewell to the US Navy F-14 Tomcat*, Cleared Hot Media, Inc.

9.7 External links

- **AN/AAQ-13 & AN/AAQ-14 LANTIRN@F-16.net**
- Targeting: in the hands of the pods International Defence Review, 7 September 2006

Chapter 10

Last meal

A **condemned prisoner's last meal** is a customary ritual preceding **execution**. Various countries have various traditions in this regard. The “little glass of rum” is granted to the **condemned in historical France** in the minutes before execution, but no formal last meal as the condemned learns of their impending execution only on the fatal morning, generally just minutes in advance.* [1]

In many countries, the prisoner may, within reason, select what the last meal will be.

10.1 Contemporary restrictions

In the United States, most states give the meal a day or two before execution and use the **euphemism** “special meal”. Alcohol or tobacco are usually denied. Unorthodox or unavailable requests are replaced with substitutes. Some states place tight restrictions. In Florida, the food for the last meal must be purchased locally and the cost is limited to \$40.* [2] In Oklahoma, cost is limited to \$15. In Louisiana, the **prison warden** traditionally joins the condemned prisoner for the last meal. On one occasion, the warden paid for an inmate's lobster dinner.* [3]

Sometimes, a prisoner shares the last meal with another inmate (as **Francis Crowley** did with John Resko) or has the meal distributed among other inmates (as requested by **Raymond Fernandez**).* [4]

In September 2011, the state of Texas abolished all special last-meal requests after condemned prisoner **Lawrence Russell Brewer** requested a huge last meal and did not eat any of it, saying he was not hungry. His last-meal request was for a plate of two **chicken-fried steaks** with gravy and sliced onions, a triple-patty bacon cheeseburger, a cheese omelet with ground beef, tomatoes, onions, bell peppers, jalapeños, a bowl of fried **okra** with ketchup, a pound of barbecued meat with half of a loaf of white bread, a portion of three **fajitas**, a **meat-lover's pizza** (topped with **pepperoni**, ham, beef, bacon, and sausage), a pint of **Blue Bell**, a serving of ice cream, a slab of **peanut-butter fudge** with crushed peanuts, and a serving equivalent to three **root beers**. The abolition followed a complaint by a **Texas Senator, John Whitmire** (Democrat, of Houston), who called the meal “inappropriate”.* [5]* [6]* [3]* [7] The tradition of customized last meals is thought to have been established around 1924 in Texas.* [8]

10.2 Documented last meal requests

This represents the items reported requested but does not, in all cases, represent what the prisoner actually received.

10.2.1 Europe

- **Charles Peace**: serial killer; UK 1879 – hanging: A breakfast consisting of eggs and a large amount of salty bacon.* [9]
- **Fritz Haarmann**: The Butcher of Hanover, serial killer; Germany 1925 – **Decapitation** by guillotine: An expensive cigar and a cup of Brazilian coffee.* [10]

- **Peter Kürten**: The Vampire of Düsseldorf, serial killer/rapist; Germany 1931 – Decapitation by guillotine: Wiener schnitzel, fried potatoes and a bottle of white wine. He requested seconds and received it. *[11]
- **Roger Casement**: Irish rebel, UK 1916 – hanging: Communion wafer. Casement entered the Catholic Church before his death and, as he said, “went to my death with the body of my God as my last meal.” *[12]

10.2.2 Asia

- **Andrew Chan and Myuran Sukumaran**: The Australian ringleaders of the Bali Nine; executed in Indonesia by firing squad in April 2015: Kentucky Fried Chicken *[13]
- **Leo Echegaray**: rapist of his 10-year old stepdaughter; executed in the Philippines by lethal injection in February 1999: He ordered a last meal of sardines and dried fish. When the reprieve was announced, he shared the food with relatives who had gathered at the prison. *[14]
- **Adolf Eichmann**: World War II German Nazi senior officer and Holocaust mass murder organizer; (German national) Israel 1962 – hanging: declined a special meal, preferring a bottle of Carmel, a dry red Israeli wine, along with the usual prison fare of cheese, bread, olives, and tea. He drank about half of the bottle. *[15]
- **Mona Fandey**: murderer; Malaysia 2001 – hanged at Kajang Prison: declined a last meal; she was instead given a dinner of KFC. *[16] *[17]
- **Saddam Hussein**: Iraqi President; Iraq 2006 – hanging: *The Times* states that “he refused their offers of cigarettes and a last meal of chicken and shawarma rice.” *[18] Other sources state a variety of meal options. *[19]
- **Ajmal Kasab**: terrorist involved in the 2008 Mumbai attacks; hanged at Pune's Yerawada jail, 21 November 2012: declined a last meal; he was given a basket of tomatoes and regular jail food. *[20]
- **John Martin Scripps**: serial killer; Singapore 1996 – hanging: a pizza and a cup of hot chocolate. *[21]

10.2.3 Canada

- **Arthur Lucas and Ronald Turpin**: last to be executed in Canada; 1962 – hanging: steak, potatoes, vegetables and pie. *[22]

10.2.4 United States

- **Aileen Wuornos**: serial killer; executed in Florida in 2002 – lethal injection: Declined a special meal, but had a hamburger and other snack food from the prison's canteen. Later, she drank a cup of coffee. *[23]
- **Bruno Richard Hauptmann**: Lindbergh kidnapping and murder; executed in New Jersey in 1936 – electrocution: Celery, olives, chicken, french fries, buttered peas, cherries, and a slice of cake. *[15]
- **Clarence Ray Allen**: murderer; executed in California in 2006 – lethal injection: Buffalo steak, Kentucky Fried Chicken, sugar-free pecan pie and sugar-free black walnut ice cream. *[24]
- **Danny Rolling**: The Gainesville Ripper, serial murderer; executed in Florida in 2006 – lethal injection: Lobster tail, butterfly shrimp, baked potato, strawberry cheesecake, and sweet tea. *[25]
- **David Alan Gore**: serial killer; executed in Florida in 2012 – lethal injection: Fried chicken, french fries & butter pecan ice cream. *[26]
- **Gary Carl Simmons, Jr.**: 1996 murderer; executed in Mississippi in 2012 – lethal injection: one Pizza Hut medium Super Supreme Deep Dish pizza with double portions of mushrooms, onions, jalapeño peppers, and pepperoni, a second pizza with three cheeses, olives, bell pepper, tomato, garlic, and Italian sausage, 10 8-oz. packs of Parmesan cheese, 10 8-oz. packs of ranch dressing, one family size bag of Doritos nacho cheese flavor, 8 oz. jalapeño nacho cheese, 4 oz. sliced jalapeños, 2 large strawberry shakes, two 20-oz. cherry Cokes, one super-size order of McDonald's fries with extra ketchup and mayonnaise, and two pints of strawberry ice cream. He consumed about half of the meal. *[27]

- **Gary Gilmore**: murderer; executed in Utah in 1977 – firing squad: A hamburger, hard-boiled eggs, a baked potato, a few cups of coffee, and three shots of contraband **Jack Daniel's** whiskey. ^{*}[15] ^{*}[28] ^{*}[29]
- **Hastings Arthur Wise**: mass murderer; executed in South Carolina in 2005 – lethal injection: Lobster tail, french fries, coleslaw, banana pudding and milk. ^{*}[30]
- **Joe Arridy**: falsely accused of rape and murder; executed in Colorado in 1939 – asphyxiation by gas chamber, posthumously pardoned in 2011: Ice Cream. ^{*}[31]
- **John Allen Muhammad**: The Beltway Sniper, murder; executed in Virginia in 2009 – lethal injection: Chicken with red sauce and several cakes. ^{*}[32]
- **John Wayne Gacy**: Serial murderer; executed in Illinois in 1994 – lethal injection: A dozen deep-fried shrimp, a bucket of original recipe chicken from **KFC**, French fries, and a pound of strawberries. ^{*}[28]
- **Kenneth Allen McDuff**: The Broomstick Killer, serial killer; executed in Texas in 1998 – lethal injection: A hamburger crafted to resemble a steak. ^{*}[33]
- **Ledell Lee**, executed in Arkansas in 2017 for the alleged murder of his neighbor; chose to receive **Holy Communion** as his last meal. ^{*}[34]
- **Michael Bruce Ross**: serial murder; executed in Connecticut in 2005 – lethal injection: Declined a special meal, but dined on the regular prison meal of the day: turkey à la king with rice, mixed vegetables, white bread, fruit, and a beverage. ^{*}[35]
- **Rainey Bethea**: Murder/Rape, last person executed in public in the US; executed in Kentucky in 1936 – hanged: Fried chicken, pork chops, **mashed potatoes**, pickled cucumbers, **cornbread**, lemon pie, and ice cream. ^{*}[36]
- **Richard Cooley**: Murder/Rape, executed in Ohio in 2008 - lethal injection, Clemency appeal based on his being too overweight for lethal injection drugs to work on him properly: T-bone steak with A-1 sauce, onion rings, French fries, four eggs over easy, toast with butter, hash browns, a pint of rocky road ice cream, a Mountain Dew soft drink and authentic bear claw pastries ^{*}[37]
- **Ruth Snyder**: American murderer photographed in the electric chair; executed in New York in 1928 – electrocution: Chicken Parmesan with alfredo pasta, ice cream, 2 milkshakes, and a 12-pack of grape soda. ^{*}[9]
- **Ted Bundy**: Serial killer; executed in Florida in 1989 – electrocution: declined a special meal, so he was given (but did not eat) the traditional steak (medium-rare), eggs (over easy), **hash browns**, toast, milk, coffee, juice, butter, and jelly. ^{*}[15] ^{*}[38]
- **Timothy McVeigh**: domestic terrorist/mass murder; **Oklahoma**, executed in Indiana in 2001 – lethal injection: Two pints of mint chocolate chip ice cream. ^{*}[39] ^{*}[40]
- **Velma Barfield**: murderer, executed in **North Carolina** in 1984 – lethal injection: Declined a special meal, having a bag of **Cheez Doodles** and a 12-ounce can of **Coca-Cola** instead. ^{*}[41]
- **Westley Allan Dodd**: The Vancouver Child Killer, serial killer and child molester, executed in Washington state in 1993 – hanging: Salmon and potatoes. ^{*}[42]
- **William Bonin**: serial murderer and rapist, executed in California in 1996 – lethal injection: Two pepperoni and sausage pizzas, three servings of chocolate ice cream, and three six-packs of Coca-Cola and Pepsi. ^{*}[43]
- **William G. Zuern, Jr.**: Murderer, executed in Ohio in 2004: mashed potatoes and gravy, lasagna, macaroni and cheese, corn, garlic bread, chocolate milk, and cherry cheesecake.

10.2.5 Other prisoner requests

- **Allen Lee Davis**, murderer, executed in Florida in 1999: 350-pound “Tiny” Davis had one **lobster** tail, fried potatoes, a half-pound of fried **shrimp**, six ounces of fried clams, half a loaf of garlic bread, and 32 ounces of A&W root beer. ^{*}[44]
- **Alton Coleman**, executed in Ohio in 2002: Well done filet mignon smothered with mushrooms, fried chicken breasts, a salad with French dressing, sweet potato pie with whipped cream, French fries, collard greens, onion rings, cornbread, broccoli with melted cheese, biscuits and gravy, and a cherry Coke.

- **Andrew Lackey**, executed in Alabama in 2013: Turkey bologna, French fries, and grilled cheese.
- **Ángel Nieves Díaz**, murderer, executed in Florida in 2006: Declined a special meal. He was served the regular prison meal for that day, but declined that as well. *[45]
- **Barton Kay Kirkham**, executed in Utah in 1958: Pizzas and ice cream, “because you get cheese, meat and everything in one meal. Not so much fuss.” *[46]
- **Brian Steckel**, executed in Delaware in 2005: **Cheesesteak**, coleslaw, and a Pepsi.
- **Cal Coburn Brown**, executed in Washington State in 2010: Combination meat pizza, apple pie, coffee, and milk.
- **Charles Starkweather**, murderer, executed in Nebraska in 1959: Declined the usual steak dinner, asking for cold cuts instead.
- **Daniel Anthony Lucas**, executed in Georgia in 2016: Meat pizza, steak and cheese calzone, stuffed Portobello mushroom, chef salad with ranch and honey mustard dressings, and orange juice.
- **David Thomas Dawson**, executed in Montana in 2006: Two double cheeseburgers, two large servings of French fries, a half gallon of vanilla fudge ripple ice cream, and two Dr. Peppers.
- **Dennis Wayne Bagwell**, executed in Texas in 2005: Medium rare steak with **A1 Steak Sauce**, fried chicken breasts and thighs, BBQ ribs, French fries, onion rings, bacon, scrambled eggs with onions, fried potatoes with onions, sliced tomatoes, salad with ranch dressing, two hamburgers, peach pie, milk, coffee, and iced tea with real sugar. *[47]
- **Dennis McGuire**, executed in Ohio in 2014: Roast beef, fried chicken, fried potatoes, a bagel with cream cheese, a Coke and butter pecan ice cream.
- **Desmond Keith Carter**, executed in North Carolina in 2002, Declined a special meal, but had two cheeseburgers, a steak sub, and two Cokes from the prison canteen, for which he paid \$4.20 from his prison account. *[23]
- **Dobie Gillis Williams**, executed in Louisiana in 1999: Twelve **chocolate bars** and some ice cream.
- **Douglas Wright**, executed in Oregon in 1996: One honeybun.
- **Edward Hartman**, executed in North Carolina in 2003: A Greek salad, linguini with white **clam sauce**, cheese-cake with cherry topping, garlic bread, and a Coke. *[48]
- **Edward Schad**, executed in Arizona in 2013: A footlong meatball sub, a large order of french fries with ketchup, two ears of corn on the cob, two ounces of cranberry sauce, a slice of apple pie, and a vanilla milkshake.
- **Elijah Page**, executed in South Dakota in 2007: Steak, jalapeño poppers with cream sauce, onion rings, a salad with cherry tomatoes, ham chunks, shredded cheese, bacon bits, and blue cheese and ranch dressing, coffee, lemon iced tea, and ice cream.
- **Eric Nance**, executed in Arkansas in 2005: Two bacon cheeseburgers, french fries, two pints of chocolate chip cookie dough ice cream, and two **Coca-Colas**.
- **Eric Wrinkles**, executed in Indiana in 2009: Prime rib, a “loaded” baked potato, pork chops with steak fries, rolls and two salads with ranch dressing, served three days before execution because **Indiana State Prison** system found that condemned inmates tend to lose their appetite near the end. *[49]
- **Francis Crowley**, executed in New York in 1932: Steak and onions, French fries, apple pie, ice cream and melted ice cream. *[11]
- **Frederick Treesh**, executed in Ohio in 2013: Steak with mushrooms, eggs, hash browns, cottage cheese, onion rings, deep-fried mushrooms, a hot fudge sundae and sodas. *[50]
- **Gary Lee Davis**, executed in Colorado in 1997: Chocolate and vanilla ice cream cups, shared with the prison superintendent and a manager. *[51]
- **Gary Michael Heidnik**, executed in Pennsylvania in 1999: Two slices of a cheese pizza and two cups of black coffee. *[52]

- Gerald Lee Mitchell, executed in Texas in 2001: Assorted bag of Jolly Rancher candies.
- Herbert Smulls, executed in Missouri in 2014: Fried chicken, steak, collard greens, macaroni and cheese, candied yams, cornbread, a cola, and chocolate cake.
- Ignacio Cuevas, perpetrator of the 1974 Huntsville Prison Siege, executed in Texas in 1991: Chicken and dumplings, steamed rice, sliced bread, black-eyed peas, and iced tea. * [53]
- James Edward Smith, executed in Texas in 1990: A lump of dirt, which was denied. He settled for a cup of yogurt.
- James Neil Tucker, executed in South Carolina in 2004: Pizza, two BLT sandwiches, and Mountain Dew.
- John Albert Taylor, executed in Utah in 1996: Pizzas “with everything.” * [54]
- John David Duty, executed in Oklahoma in 2010: A double cheeseburger with mayonnaise, a foot-long hot dog with cheese, mustard and extra onions, a cherry limeade, and a large banana shake. * [55]
- Joseph Paul Franklin, executed in Missouri in 2013: Declined the traditional last meal, but had a lunch of roast beef and potatoes.
- Joseph Mitchell Parsons, executed in Utah in 1999: Three Burger King Whoppers, two large orders of fries, a chocolate shake, chocolate chip ice cream, and a package of grape Hubba Bubba bubblegum, to be shared with his brother and a cousin. * [56]
- Joseph Taborsky, executed in Connecticut in 1960: Banana split, cherry soda, coffee with cream and sugar, and a pack of cigarettes.
- Karla Faye Tucker, executed in Texas in 1998: Banana, peach, and garden salad with ranch dressing. * [57]
- Keith Zettlemoyer, executed in Pennsylvania in 1995: Two cheeseburgers, fries, chocolate pudding and chocolate milk. * [58]
- Lawrence Russell Brewer, executed in Texas in 2011: Two chicken fried steaks smothered in gravy with sliced onions; a triple meat bacon cheeseburger with fixings on the side; a cheese omelet with ground beef, tomatoes, onions, bell peppers and jalapeños; a large bowl of fried okra with ketchup; one pound of barbecue with half a loaf of white bread; three fajitas with fixings; a Meat Lovers pizza; three root beers; one pint of Blue Bell vanilla ice cream; and a slab of peanut butter fudge with crushed peanuts. * [59] Brewer's request was granted, but he refused the meal when it arrived, prompting Texas to stop granting last meal requests to condemned inmates. * [60]
- Lowell Lee Andrews, executed in Kansas in 1962: Two fried chickens with sides of mashed potatoes, green beans and Pie a la Mode. * [61]
- Marion Albert Pruett, executed in Arkansas in 1999: A stuffed crust pizza from Pizza Hut, four Burger King Whoppers, a large order of French fries, three two-liter bottles of Pepsi, a bucket of ice, a bottle of ketchup, salt, fried eggplant, fried squash, fried okra, and a pecan pie. In an interview prior to his execution date, he said he was going to share his last meal with another inmate who was going to be executed the same day. He went on to say he originally wanted to have a roast duck for his last meal, but declined because he felt the prison wouldn't cook it.
- Mark Dean Schwab, executed in Florida in 2008: Fried eggs (over easy), bacon, sausage links, hash browns, buttered toast, and a quart of chocolate milk.
- Mark Hopkinson, executed in Wyoming in 1992: Pizza, shared with his mother and other family members.
- Odell Barnes, executed in Texas in 2000: “Justice, Equality, World Peace.” * [57]
- Paul Ezra Rhoades, executed in Idaho in 2011: Hot dogs, sauerkraut, baked beans, veggie sticks, fruit with gelatin and strawberry ice cream cups.
- Perry Smith and Richard Hickock, executed in Kansas in 1965: Shrimp, French fries, garlic bread, ice cream, and strawberries with whipped cream. * [15]

- Philip Workman, executed in Tennessee in 2007: Declined a special meal for himself, but he asked for a large vegetarian pizza to be given to a homeless person in Nashville, Tennessee. This request was denied by the prison, but carried out by others across the country. * [62] * [63]
- Ralph Hudson, executed in New Jersey in 1963: Prime rib steak, ice cream and a cigar.
- Martha Beck, executed in New York in 1951: Fried chicken, fried potatoes and salad. * [11]
- Raymond Fernandez, executed in New York in 1951: Onion omelet, french fries, chocolate candy, and a Cuban cigar.
- Ricky Ray Rector, executed in Arkansas in 1992: Steak, fried chicken, cherry Kool-Aid, and a pecan pie. Rector, rendered mentally incapacitated by his suicide attempt after murdering a police officer, said that he did not eat the pie because he was saving it for later. * [64]
- Richard Kiefer, murder, executed in Indiana in 1961: fried chicken, french fries, banana cream pie and vanilla ice cream.
- Robert Alton Harris, executed in California in 1992: A 21-piece bucket of Kentucky Fried Chicken, two large Domino's Pizzas (no anchovies), ice cream, a bag of jelly beans, a six-pack of Pepsi, and a pack of Camel cigarettes. * [65] * [66] The pizza was actually a Tombstone Pizza, per Vernell Crittendon's orders. * [67] Crittendon worked at the prison and was responsible for dealing with the condemned person before his execution.
- Robert Dale Conklin, murderer, executed in Georgia in 2005: Filet mignon wrapped in bacon, de-veined shrimp sauteed in garlic butter with lemon, a baked potato with butter, sour cream, chives & real bacon bits, corn on the cob, asparagus with hollandaise sauce, French bread with butter, goat cheese, cantaloupe, apple pie with vanilla bean ice cream and an iced tea.
- Ronald Clark O'Bryan, executed in Texas in 1984: T-bone steak (medium to well done), French fries with ketchup, whole kernel corn, sweet peas, a lettuce and tomato salad with egg and French dressing, iced tea, sweetener, saltines, Boston cream pie, and rolls. * [57]
- Ronnie Lee Gardner, executed in Utah in 2010: Lobster tail, steak, apple pie, vanilla ice cream, 7 Up, and watching *The Lord of the Rings* film trilogy. * [68]
- Stephen Wayne Anderson, executed in California in 2002: Two grilled cheese sandwiches, one pint of cottage cheese, a hominy/corn mixture, one piece of peach pie, one pint of chocolate chip ice cream, and radishes. * [69]
- Teresa Lewis, executed in Virginia in 2010: Two fried chicken breasts, sweet peas with butter, a Dr Pepper and German chocolate cake for dessert. * [70] * [71]
- Terry Douglas Clark, executed in New Mexico in 2001: Several jumbo shrimp, French fries, fried okra, peach cobbler, ice cream, and a Coke.
- Terry Jess Dennis, executed in Nevada in 2004: Two cheeseburgers and a Coke with ice.
- Thomas J. Grasso, executed in Oklahoma in 1995: two dozen steamed mussels, two dozen steamed clams, a double cheeseburger from Burger King, half-dozen barbecued spare ribs, two strawberry milkshakes, half a pumpkin pie with whipped cream and diced strawberries, and a 16-ounce can of spaghetti with meatballs, served at room temperature. * [72] However, he issued a public statement complaining that he had requested SpaghettiOs, not spaghetti. * [73]
- Troy Davis, executed in Georgia in 2011, declined a special meal, explaining that "this meal will not be my last". * [74]
- Victor Feguer, executed in Iowa in 1963, requested a single olive with the pit still in it. * [75]
- Wesley Baker, executed in Maryland in 2005: Breaded fish, pasta marinara, green beans, orange fruit punch, bread, and milk (this was what was on the prison menu that day). * [76]

10.3 See also

- Capital punishment
- Death row
- Final statement
- Last Supper
- Religion and capital punishment

10.4 References

- [1] Lynn-George, Michael. "The Writing Lesson: From the Dragon's Teeth to Tristes Tropiques" . *The International Journal of the Humanities*. 4 (8): 61–72. Retrieved 23 September 2011.
- [2] "Death Row Fact Sheet" . *Florida Department of Corrections*. Archived from the original on 12 June 2008. Retrieved 11 November 2007.
- [3] "Last-meal requests come to an end on Texas death row" .
- [4] *The Book of Lists #3*. Bantam. 1983. pp. 85–87. ISBN 0-553-27868-1.
- [5] Ward, Mike. "Last Meals for Condemned Cons Off Menu" . *Austin American Statesman*.
- [6] "Texas jails abolish last meals after uneaten banquet" . *BBC Online*. 23 September 2011. Retrieved 24 September 2011.
- [7] Fernandez, Manny (23 September 2011). "Texas Death Row Kitchen Cooks Its Last 'Last Meal'" . *The New York Times*. Retrieved 24 September 2011.
- [8] "Last-meal requests off death row menu" .
- [9] *The Book of Lists #3*. Bantam. 1983. p. 85. ISBN 0-553-27868-1.
- [10] *Southeast Missourian* Apr. 15, 1925
- [11] *The Book of Lists #3*. Bantam. 1983. p. 86. ISBN 0-553-27868-1.
- [12] "Roger Casement" .
- [13] "Bali Nine executions: Families of Andrew Chan, Myuran Sukumaran say last goodbyes" . *News.com.au*. 29 April 2015. Retrieved 5 May 2015.
- [14] "Asia-Pacific – Philippines stay of execution welcomed" . *BBC News* –.
- [15] "No Seconds" . *TIME Magazine*. 23 May 1994. Retrieved 11 August 2007.
- [16] "Mona Fandey – A modern witchcraft murder." . *CapitalpunishmentUK.org*. Retrieved 24 April 2013.
- [17] "Mona Fandey, hubby and assistant hanged" . *The Star (Malaysia)*. 3 November 2001. Retrieved 24 April 2013.
- [18] Ned Parker and Ali Hamdani (1 January 2007). "How one mobile phone made Saddam's hanging a very public execution" . *The Times (UK)*. London. Retrieved 7 May 2010.
- [19] Google. "Saddam Hussein Last Meal" . *Google*.
- [20] Shaikh, Asseem; Mihir Tanksale; Umesh Isalkar (22 November 2012). "Ajmal Kasab sang in cell the night before" . *Times of India*. Pune. TNN. Retrieved 7 December 2012.
- [21] "John Martin Scripps" . *Capitalpunishmentuk.org*. Retrieved 2013-06-29.
- [22] *The Last to Die: Ronald Turpin, Arthur Lucas, and the End of Capital Punishment in Canada*. Dundurn. 2007. p. 176. ISBN 978-1550026726.
- [23] "Last Meals on Death Row (2002)". *Dead Man Eating*. Retrieved 11 August 2007.
- [24] "Clarence Ray Allen" . *Clark County Prosecutor*. Retrieved 29 September 2010.

- [25] "'Gainesville Ripper' Danny Rolling Executed" . WESH. 25 October 2006. Retrieved 18 October 2010.
- [26] "Gore executed, nearly 30 years after string of murders" . *Gainesville Sun*. Retrieved 2012-04-12.
- [27] "The 29,000 calorie last meal: Murderer who dismembered his victim requests last meal with two pizzas, five lbs of cheese, super sized french fries, nachos, cherry Cokes, milkshakes, strawberry ice cream and more" . *Daily Mail*. 21 June 2012. Retrieved 22 June 2012.
- [28] John Peck (5 January 2006). "Last Meals" . *Tucson Weekly*. Retrieved 11 August 2007.
- [29] Katherine Ramsland. "Gary Gilmore: Death Wish" . *Crime Library*. Retrieved 11 August 2007.
- [30] "Famous Death Row Last Meals" . *Huffington Post*. 17 June 2011. Retrieved 16 February 2017.
- [31] "'Happiest Man" in death cell dies in chair" . *St. Petersburg Times*. Jan 7, 1939. Retrieved 10 January 2011.
- [32] Meserve, Jeanne; Mike M. Ahlers (11 November 2009). "Sniper John Allen Muhammad executed" . Jarratt, Virginia: CNN. Retrieved 2 October 2010. The lawyer said Muhammad's last meal was "chicken and red sauce, and he had some cakes.
- [33] Texas Monthly, August 1992, "Freed to Kill"
- [34] Kandra, Greg (22 April 2017). "Ledell Lee's last meal: Holy Communion" . *Aleteia*. Retrieved 23 April 2017.
- [35] "Michael Bruce Ross" . Clark County Prosecutor. Retrieved 7 January 2010.
- [36] Ryan, Perry T. (1992). "24. Final Preparations for the Hanging" . *The Last Public Execution in America*. Ryan, Perry T. ISBN 0-9625504-5-0. Retrieved 31 January 2011.
- [37] <http://www.clarkprosecutor.org/html/death/US/cooey1124.htm>
- [38] Paula Tully Bryant. "Timeline: 1989 – A History of Corrections in Florida" . *Florida Department of Corrections*. Retrieved 11 August 2007.
- [39] Catherine Quayle (11 June 2001). "Execution of an American Terrorist" . *Court TV*.
- [40] Rita Cosby (12 June 2001). "Timothy McVeigh Put to Death for Oklahoma City Bombings" . *FOX News*. Retrieved 11 August 2007.
- [41] Schmidt, William (3 November 1984). "First Woman Is Executed in U.S. Since 1962" . *The New York Times*. Retrieved 11 August 2007.
- [42] Egan, Timothy. "For First Time Since '65, A State Uses Its Gallows" . *The New York Times*. Retrieved 2 March 2017.
- [43] Mark Gribben. "William Bonin: The Freeway Killer" . *Crime Library*. Retrieved 11 August 2007.
- [44] "Allen Lee "Tiny" Davis" . Clark County Prosecutor. Retrieved 17 April 2008.
- [45] "Last Meals on Death Row (2006)". *Dead Man Eating*. Retrieved 11 August 2007.
- [46] "Killer Calmly Goes To Death" . *The Florence Times*. Associated Press. 7 June 1958. p. 1. Retrieved 4 October 2010.
- [47] "Dennis Wayne Bagwell" . Clark County Prosecutor. Retrieved 3 July 2008.
- [48] "Last Meals on Death Row (2003)". *Dead Man Eating*. Retrieved 11 August 2007.
- [49] "Wrinkles Awaits Death For Triple Murder" . WRTV. 10 December 2009. Retrieved 18 October 2010.
- [50] "'If you want me murdered, just say it': Last words of Ohio death row inmate put to death for 1994 murder of security guard during week-long crime rampage" . *Daily Mail*. 6 March 2013. Retrieved 13 August 2014.
- [51] Ryckman, Lisa (14 October 1997). "Davis pays final price" . *Rocky Mountain News*. Archived from the original on 17 June 2009. Retrieved 18 October 2010.
- [52] Wolcott, Martin Gilman (1 January 2004). *The Evil 100*. Citadel Press. p. 286. ISBN 978-0-8065-2555-6. Retrieved 5 June 2010.
- [53] "Final Meal Requests." Texas Department of Criminal Justice. 1 October 2003. Retrieved on 4 December 2010.
- [54] Hal Schindler (28 January 1996). "Taylor's Death Was Quick . . . But Some Weren't So Lucky" . *The Salt Lake Tribune*. Retrieved 26 June 2010.

- [55] Murphy, Sean (17 December 2010). "Oklahoma executes man with new drug combination". *The Oklahoman*. Associated Press. Retrieved 31 January 2011.
- [56] Bryson, Amy Joi (14 October 1999). "Death wish Execution comes 12 years after murder at rest stop". *Deseret News*. p. 3. Retrieved 27 September 2010.
- [57] "Final Meal Requests". *Texas Department of Criminal Justice*. 12 September 2003. Archived from the original on 2 December 2003. Retrieved 11 August 2007.
- [58] "Man Put to Death in Pennsylvania". *San Francisco Chronicle*. 3 May 1995. Retrieved 18 October 2010.
- [59] Scott Lawrence (21 September 2011). "Lawrence Russell Brewer refuses to eat final meal". *KFDM News*. Archived from the original on 2012-02-17. Retrieved 2013-02-10.
- [60] "Texas kills fancy last meal requests on death row". *Reuters*. 23 September 2011. Retrieved 22 September 2011.
- [61] *The Book of Lists #3*. Bantam. 1983. pp. 86–87. ISBN 0-553-27868-1.
- [62] Ashley Fantz (9 May 2007). "Killer orders pizza for homeless as last meal". *CNN*. Archived from the original on 15 May 2007. Retrieved 11 August 2007.
- [63] "Last Meals on Death Row (2007)". *Dead Man Eating*. Retrieved 12 August 2007.
- [64] Beam, Christopher. "Can a prisoner request anything for his last meal?". *Slate*. Retrieved 5 June 2010.
- [65] "Capital Punishment – Harris, Robert Alton". *California Department of Corrections and Rehabilitation*. Archived from the original on 8 August 2007. Retrieved 11 August 2007.
- [66] Lance Morrow (4 May 1992). "Television Dances With the Reaper". *TIME Magazine*. Retrieved 11 August 2007.
- [67] Jonathan Kellerman, ed. (2008). "Dean of Death Row (by Tad Friend)". *The best American crime reporting, 2008*. New York: Harper Perennial. p. 143. ISBN 0-06-149083-0.
- [68] Sanchez, Ray (18 June 2010). "Ronnie Lee Gardner Executed by Firing Squad in Utah". *Good Morning America*. pp. 1–4. Retrieved 18 June 2010.
- [69] "Stephen Wayne Anderson". *Clark County Prosecutor*. Retrieved 29 September 2010.
- [70] Glod, Maria (23 September 2010). "Teresa Lewis pronounced dead by Va. authorities". *The Washington Post*. p. 2. Retrieved 23 September 2010.
- [71] "Virginia executes its first woman since 1912 as Teresa Lewis dies by lethal injection amid international outcry". *Daily Mail*. 24 September 2010. Retrieved 13 August 2014.
- [72] Collins, Nick (7 December 2010). "Last meals: weird requests on death row". *The Daily Telegraph*. Retrieved 5 December 2011.
- [73] Schwartzman, Paul; Finnegan, Michael (20 March 1995). "Grasso Is Put To Death; Poem, Complaint His Final Words". *New York Daily News*. Retrieved 26 December 2009.
- [74] Savali, Kirsten West (21 September 2011). "Troy Davis To Refuse His Last Meal: 'This Meal Will Not Be My Last'". *Your Black World*. Retrieved 5 December 2011.
- [75] "Federal govt.'s last execution was in Iowa in 1963". *USA Today*. 20 June 2001. Retrieved 11 August 2007.
- [76] "Last Meals on Death Row (2005)". *Dead Man Eating*. Retrieved 11 August 2007.

10.5 Further reading

- Treadwell, Ty and Vernon, Michelle (2011) *Last Suppers: Famous Final Meals from Death Row*
- Van Dülmen, Richard (1990). *Theatre of Horror : Crime and Punishment in Early Modern Germany*. Cambridge. ISBN 0-7456-0616-4.
- Foucault, Michel (1977). *Discipline & Punish : The Birth of the Prison*. ISBN 0-679-75255-2.
- Von Hentig, Hans (1973). *Punishment – Its Origin, Purpose, and Psychology*. ISBN 0-87585-147-9.
- Osler, Mark (February 2009). "Ch. 7: Last Meal / Last Supper". *Jesus on Death Row: The Trial of Jesus and American Capital Punishment*. Nashville, Tennessee: Abingdon Press. pp. 63–67. ISBN 978-0-687-64756-9.

10.6 External links

- Greene, Bob (12 June 2001). They didn't get to choose their last meals. *Jewish World Review*. Retrieved on 2007-08-17.
- Karon, Tony (10 August 2000). Why We're Fascinated by Death Row Cuisine. *TIME Magazine*. Retrieved on 2007-08-17.
- Stein, Joel (18 October 2007). You Eat What You Are. *TIME Magazine*. Retrieved on 2007-11-11.
- Famous Last Meals. *Portraits of Last Requests*. Retrieved on 2010-09-17.
- Final Meal Requests. *Texas Department of Criminal Justice* (12 September 2003). Archived from the original on 2003-12-02. Retrieved on 2011-03-17.
- Last Meals. *rotten dot com*. Retrieved on 2007-08-17.
- Last Meals: What Would You Order? *Seattle Weekly* (18 June 2010). Retrieved on 2010-06-24.
- Last Meals on Death Row (since 2002). *Dead Man Eating*. Retrieved on 2007-08-17.
- Top 10 Death Row Last Meal Requests from Texas. *Zombie Popcorn* (9 October 2008) Retrieved on 2010-09-29.

Chapter 11

Law of Jante

The **Law of Jante** (Danish: *Janteloven*, IPA: ['jandə,løv'ən]; Norwegian Bokmål: *Janteloven*, Nynorsk: *Jantelova*, IPA: ['jantə,løvən]; Icelandic: *Jantelögin*; Swedish: *Jantelagen*, IPA: ['jantə,lɑ:ɡen]) is the description of a pattern of group behaviour towards individuals within Nordic countries that negatively portrays and criticises individual success and achievement as unworthy and inappropriate. The Jante Law as a concept was created by the Dano-Norwegian author Aksel Sandemose,*[1] who, in his novel *A Fugitive Crosses His Tracks* (*En flyktning krysser sitt spor*, 1933, English translation published in the USA in 1936), identified the Law of Jante as ten rules. Sandemose's novel portrays the small Danish town Jante (modelled upon his native town *Nykøbing Mors* as it was at the beginning of the 20th century, but typical of all small towns and communities), where nobody is anonymous.*[2]

Generally used colloquially in Sweden and the rest of the Nordic countries as a sociological term to describe a condescending attitude towards individuality and success, the term refers to a mentality that de-emphasises individual effort and places all emphasis on the collective, while discouraging those who stand out as achievers.*[3]

11.1 Definition

There are ten rules in the law as defined by Sandemose, all expressive of variations on a single theme and usually referred to as a homogeneous unit: *You are not to think you're anyone special or that you're better than us.*

The ten rules state:

1. You're not to think *you* are anything special.
2. You're not to think *you* are as good as *we* are.
3. You're not to think *you* are smarter than *we* are.
4. You're not to imagine yourself better than *we* are.
5. You're not to think *you* know more than *we* do.
6. You're not to think *you* are more important than *we* are.
7. You're not to think *you* are good at anything.
8. You're not to laugh at *us*.
9. You're not to think anyone cares about *you*.
10. You're not to think *you* can teach *us* anything.

These ten principles or commandments are often claimed to form the “Jante's Shield” of the Scandinavian people.

In the book, the Janters who transgress this unwritten 'law' are regarded with suspicion and some hostility, as it goes against the town's communal desire to preserve harmony, social stability and uniformity.

An eleventh rule recognised in the novel as 'the penal code of Jante' is:

1. Perhaps you don't think *we* know a few things about *you*?

11.2 Present

Sandemose wrote about the working class in the town of Jante, a group of people of the same social position. He expressly stated in later books that the social norms of Jante were universal and not intended to depict any particular town or country. It should be understood that Sandemose was seeking to formulate and describe attitudes that had already been part of the Danish and Norwegian psyche for centuries. Today, however, it is common in Scandinavia to claim the Law of Jante as something quintessentially Danish, Norwegian or Swedish.

Later, the meaning of the Law of Jante was extended to refer to personal criticism of people who want to break out of their social groups and reach a higher position in society in general. *^[4]

11.3 See also

- Crab-bucket syndrome
- Lagom
- Social model
- Tall poppy syndrome
- Other cultures
 - Danish culture
 - German culture
 - Norwegian culture
 - Prussian virtues
 - Swedish culture

11.4 References

- [1] Scott, Mark (18 December 2003). “Signs of Cracks in the Law of Jante” . The New York Times. Retrieved 2013-12-22. Taken from a book by the Danish author Aksel Sandemose, the concept suggests that the culture within Scandinavian countries discourages people from promoting their own achievements over those of others.
- [2] Translator note, *En flyktning krydser sit spor*, 2nd ed.
- [3] Adleswärd, Viveka (2 November 2003). “Avundsjukan har urgamla anor” [Jealousy has ancient ancestry]. *Svenska Dagbladet* (in Swedish). Retrieved 28 April 2015.
- [4] Andersen, Steen (6 July 1992). “Den løbske Jantelov” [The Runaway Jante Law]. *Morsø Folkeblad*. Retrieved 28 April 2015.

11.5 Further reading

- Sandemose, Aksel (1933). *En flyktning krydser sitt spor*. Oslo: Aschehoug (Repr. 2005). ISBN 82-03-18914-8
- Sandemose, Aksel (1936). *A fugitive crosses his tracks*. translated by Eugene Gay-Tifft. New York: A.A. Knopf.
- Koldau, Linda Maria (2013): *Jante Universitet*. (Jante University). Vol. 1: Den skønne facade (The Beautiful Facade); Vol. 2: Uddannelseskatastrofen (Educational Disaster); Vol. 3: Totalitære strukturer (Totalitarian Structures). Hamburg: Tredition. ISBN 978-3-8495-0351-2 (Vol. 1); ISBN 978-3-8495-0350-5 (Vol. 2); ISBN 978-3-8495-0266-9 (Vol. 3). In Danish language.
- Koldau, Linda Maria (2013): *Educational Disaster. The Destruction of Our Universities: The Danish Case*. (abridged English version of *Jante Universitet* containing the most important analyses and a chapter on Jante Law mentality in Danish education). Hamburg: Tredition (forthcoming). ISBN 978-3-8495-4936-7. In English language.

- Steffen, Juliane (2011): “Hjem til Jante” (Home to Jante), concise analysis of the mechanisms of Jante Law at Danish universities, published in: Linda Maria Koldau: *Jante Universitet. Vol. 2: Uddannelseskatastrofen*. Hamburg: Tredition, 2013, pp. 464–466. ISBN 978-3-8495-0350-5 (Vol. 2). In Danish language.

Andersen, Steen: Nye forbindelser. Pejlinger i Aksel Sandemoses forfatterskab. Vordingborg: Attika, 2015. ISBN 978-87-7528-8700. In Danish Language.

Chapter 12

Leftovers

This article is about food. For other uses, see [The Leftovers \(disambiguation\)](#).

Leftovers are the uneaten edible remains of a hot or cold meal after the meal is over and everyone has finished



Some leftover foods

eating. Food scraps that are not considered edible (such as **bones** or the skins of some **vegetables** and **fruits**) are not regarded as leftovers, but rather as **waste** material. In order for something to appropriately be classified as “leftovers”, it must constitute a meal by itself, and therefore should not be limited to just portions of the original (side-dishes, garnishments, etc.).

The ultimate fate of leftovers depends on where the meal was eaten, the preferences of the diner, and the prevailing social **culture**. Home cooking leftovers are often saved to be eaten later. This is facilitated by being in a private environment, with food-preserving facilities such as airtight containers and **refrigeration** close at hand. Some leftover food can be eaten cold from the refrigerator, while others may be reheated in a **microwave** or a conventional **oven**, or mixed with additional ingredients and recooked to make a new dish, such as **bubble and squeak**.



Packaged leftovers from a Thanksgiving meal

Though leftover or partially eaten food (*Ucchishta*) is never offered to a Hindu deity, the goddess *Matangi* is prescribed to be offered this taboo oblation to gain her grace to achieve Supreme knowledge and supernatural powers.

The word "ort", meaning a small scrap of food left after a meal is completed, is not commonly heard in conversation, but is frequently encountered in crossword puzzles.

12.1 Leftover cuisine

New dishes made from leftovers are quite common in world cuisine, and many were created in the days before refrigeration and reliable airtight containers existed. Besides capturing nutrition from otherwise inedible bones, stocks and broths make an excellent base for adding leftover morsels too small to be a meal themselves. *Casseroles*,^[1] *paella*,^[2] *fried rice*,^[3] *Shepherd pies*,^[4] and *pizza* can also be used for this purpose, and may even have been invented as a means of reusing leftovers. Among American university students, leftover pizza itself has acquired particular in-group significance, to the extent that the USDA's Food Safety and Inspection Service offers, as its first tip under "Food Safety Tips for College Students" by Louisa Graham,^[5] a discussion of the considerable risks of eating unrefrigerated pizza.^[6]

At some holiday meals, such as *Christmas* in Protestant countries and *Thanksgiving* in the United States, it is customary for the host to prepare much more food than can be eaten, specifically in order to send leftovers home with the guests. Cold *turkey* is archetypal in the United States as a Thanksgiving leftover, with turkey meat often reappearing in *sandwiches*, *soups*, and *casseroles* for several days after the feast.

During the late 19th and early 20th centuries, *Chinese cuisine* gained a foothold in the USA with the opening of several *chop suey* restaurants. There is no set history of how American diners became enamored of "chop suey"—which means "assorted pieces" or "miscellaneous leftovers"—although it is unlikely that actual leftovers were served at any chop suey restaurants.



A stew prepared from leftovers

12.2 Doggy bag

Leftovers from a **restaurant** meal may either be left behind to be discarded by the restaurant or taken away by the diner for later consumption. In order to take the food away, the diner may make a request for it to be packaged. The container used for such leftovers is commonly called a *doggy bag* or *doggie bag*. It is speculated that this derives from the **euphemistic** pretense that the food will be given to the diner's **pet**, rather than eaten by a person. ^[7] However it may also be a corruption of the **East Anglian** term *docky*, meaning lunch. ^[8] The term doggy bag was popularized in the 1970s etiquette columns of many newspapers. ^[9] Doggy bags are most common in restaurants that offer a **take-out** food service as well as sit-down meals, and their prevalence as an accepted social custom varies widely by location. In some countries, especially in Europe, some people would frown upon a diner asking for a doggy bag. ^[10]



- Restaurant patron showing his leftovers to be put in a doggy bag

12.3 See also

- Foam food container



Far East Chop Suey restaurant in Little Tokyo, Los Angeles: Restaurants like this are now rare, but were once a common sight in the United States

- Oyster pail
- Food waste
- Pagpag

12.4 References

- [1] Smith, Andrew F., ed. (2004). *Oxford Encyclopedia of Food and Drink in America*. 1. New York: Oxford University Press. p. 194.. “With the addition or subtractions of leftovers or inexpensive cuts of meat, the casserole is flexible and economical in terms of both ingredients and effort.” (As quoted in Olver, Lynne (2007-06-03). “Food Timeline history notes: ambrosia to corn bread” . *The Food Timeline*. Retrieved 2007-06-05.)
- [2] Olver, Lynne (2006-08-06). “Food Timeline--history notes: Asian-American cuisine” . Retrieved 2007-06-05. Fried rice and noodle dishes with vegetables are likewise ancient. They were typically composed of leftover ingredients and cooked in woks.
- [3] *Mrs Beeton's Book of Household Management* by Isabella Beeton, 1861.
- [4] *Cassell's New Universal Cookery Book* by Lizzie Heritage published by Cassell and Company, 1894
- [5] “Food Safety Tips for College Students” . 16 June 2013. Retrieved 10 November 2014. Perishable food should never be left out of refrigeration more than 2 hours. This is true even if there are no meat products on the pizza. Foodborne bacteria that may be present on these foods grow fastest in the “Danger Zone” (temperatures between 40 and 140 °F) and can double in number every 20 minutes.
- [6] “Cold pizza: friend or foe? Food safety in your residence hall” . *Georgetown University Health Education Services*. 2003. Archived from the original on 10 March 2012. Retrieved 2010-05-12. If a food has been out of the refrigerator for more than two hours, then it is considered unsafe and should be thrown out.
- [7] “doggy bag” . *The American Heritage Dictionary of the English Language: Fourth Edition*. 2000. Retrieved 2007-06-05.
- [8] “Docky Bag” . *University of Cambridge: Museums and Collections*. Retrieved 13 December 2016.
- [9] “The partial triumph of the doggy bag” . Retrieved 2010-09-21.
- [10] BBC - Doggy bag: Why are the British too embarrassed to ask? Retrieved 2013-03-26

Chapter 13

Lesser Key of Solomon

For other uses, see [Key of Solomon](#) (disambiguation).

The *Lesser Key of Solomon*, also known as *Clavicula Salomonis Regis*^[note 1] or *Lemegeton*, is an anonymous grimoire (or spell book) on demonology. It was compiled in the mid-17th century, mostly from materials a couple of centuries older.^[1]^[2] It is divided into five books—the *Ars Goetia*, *Ars Theurgia-Goetia*, *Ars Paulina*, *Ars Almadel*, and *Ars Notoria*.^[1]^[3]

13.1 *Ars Goetia*

The most obvious source for the *Ars Goetia* is Johann Weyer's *Pseudomonarchia Daemonum* in his *De praestigiis daemonum*. Weyer does not cite, and is unaware of, any other books in the Lemegeton, indicating that the Lemegeton was derived from his work, not the other way around.^[1]^[4] The order of the spirits was changed between the two, four additional spirits were added to the later work, and one spirit (Prufas) was omitted. The omission of Prufas, a mistake that also occurs in an edition of *Pseudomonarchia Daemonum* cited in Reginald Scot's *The Discoverie of Witchcraft*, indicates that the *Ars Goetia* could not have been compiled before 1570. Indeed, it appears that the *Ars Goetia* is more dependent upon Scot's translation of Weyer than Weyer's work in itself. Additionally, some material was used from Heinrich Cornelius Agrippa's *Three Books of Occult Philosophy*, the *Heptameron* by pseudo-Pietro d'Abano,^[note 2]^[1]^[5] and the *Magical Calendar*.^[6]

Weyer's *Officium Spirituum*, which is likely related to a 1583 manuscript titled *The Office of Spirits*,^[7] appears to have ultimately been an elaboration on a 15th-century manuscript titled *Le Livre des Esperitz* (of which 30 of its 47 spirits are nearly identical to spirits in the *Ars Goetia*).^[2]^[5]

In a slightly later copy made by Thomas Rudd, this portion was labelled “Liber Malorum Spirituum seu Goetia” , and the seals and demons were paired with those of the 72 angels of the Shemhamphorasch,^[3] who were intended to protect the conjurer and control the demons he summoned.^[8] The angelic names and seals were derived from a manuscript by Blaise de Vigenère, whose papers were also used by Samuel Liddell MacGregor Mathers in his works for the Hermetic Order of the Golden Dawn.^[5] Rudd may have derived his copy of *Liber Malorum Spirituum* from a now-lost work by Johannes Trithemius,^[5] who taught Agrippa, who in turn taught Weyer.

This portion of the work was later translated by S. L. MacGregor Mathers and published by Aleister Crowley under the title *The Book of the Goetia of Solomon the King*. Crowley added some additional invocations previously unrelated to the original work, as well as essays describing the rituals as psychological exploration instead of demon summoning.^[9]

13.1.1 The Seventy-Two Demons

Further information: [List of demons in the Ars Goetia](#)

The demons' names (given below) are taken from the *Ars Goetia*, which differs in terms of number and ranking from the *Pseudomonarchia Daemonum* of Weyer. As a result of multiple translations, there are multiple spellings for some of the names, which are given in the articles concerning them.



Buer, the tenth spirit, who teaches “Moral and Natural Philosophy” (from a 1995 Mathers edition. Illustration by Louis Breton from Dictionnaire Infernal).

1. King Bael
2. Duke Agares
3. Prince Vassago
4. Marquis Samigina
5. President Marbas
6. Duke Valefor
7. Marquis Amon
8. Duke Barbatos
9. King Paimon

10. President Buer
11. Duke Gusion
12. Prince Sitri
13. King Beleth
14. Marquis Leraje
15. Duke Eligos
16. Duke Zepar
17. Count/President Botis
18. Duke Bathin
19. Duke Sallos
20. King Purson
21. Count/President Marax
22. Count/Prince Ipos
23. Duke Aim
24. Marquis Naberius
25. Count/President Glasya-Labolas
26. Duke Buné
27. Marquis/Count Ronové
28. Duke Berith
29. Duke Astaroth
30. Marquis Forneus
31. President Foras
32. King Asmoday
33. Prince/President Gäap
34. Count Furfur
35. Marquis Marchosias
36. Prince Stolas
37. Marquis Phenex
38. Count Halphas
39. President Malphas
40. Count Räum
41. Duke Focalor
42. Duke Vepar
43. Marquis Sabnock
44. Marquis Shax
45. King/Count Viné

46. Count Bifrons
47. Duke Vual
48. President Haagenti
49. Duke Crocell
50. Knight Furcas
51. King Balam
52. Duke Alloces
53. President Caim
54. Duke/Count Murmur
55. Prince Orobas
56. Duke Gremory
57. President Ose
58. President Amy
59. Marquis Orias
60. Duke Vapula
61. King/President Zagan
62. President Valac
63. Marquis Andras
64. Duke Flauros
65. Marquis Andrealphus
66. Marquis Kimaris
67. Duke Amdusias
68. King Belial
69. Marquis Decarabia
70. Prince Seere
71. Duke Dantalion
72. Count Andromalius

The demons are described as being commanded by four kings of the cardinal directions: Amaymon (East), Corson (West), Ziminiar (North), and Gaap (South). A footnote in one variant edition instead lists them as Oriens or Uriens, Paymon or Paymonia, Arion or Egin, and Amaymon or Amaimon, alternatively known as Samael, Azazel, Azael, and Mahazael (purportedly their preferred rabbinic names).^[10] Agrippa's *Occult Philosophy* lists the kings of the cardinal directions as Urieus (East), Amaymon (South), Paymon (West), and Egin (North); again providing the alternate names Samuel (i.e. Samael), Azazel, Azael, and Mahazael. The *Magical Calendar* lists them as Bael, Moymon, Poymon, and Egin,^[11]^[12] though Peterson notes that some variant editions instead list "Asmodel in the East, Amaymon in the South, Paymon in the West, and Aegym in the North"; "Oriens, Paymon, Egin, and Amaymon"; or "Amodeo [*sic*] (king of the East), Paymon (king of the West), Egin (king of the North), and Maimon."^[11]

13.2 *Ars Theurgia Goetia*

The *Ars Theurgia Goetia* mostly derives from Trithemius's *Steganographia*, though the seals and order for the spirits are different due to corrupted transmission via manuscript.*[5]*[13] Rituals not found in *Steganographia* were added, in some ways conflicting with similar rituals found in the *Ars Goetia* and *Ars Paulina*. Most of the spirits summoned are tied to points on a compass, four Emperors tied to the cardinal points (*Carnesiel* in the East, *Amenadiel* in the West, *Demoriel* in the North and *Caspiel* in the South), sixteen Dukes tied to cardinal points, inter-cardinal points, additional directions between those. There are an additional eleven Wandering Princes, totaling thirty one spirit leaders who each rule several to a few dozen spirits.*[14]

13.3 *Ars Paulina*

Derived from book two of Trithemius's *Steganographia* and from portions of the *Heptameron*, but purportedly delivered by Paul the Apostle instead of (as claimed by Trithemius) *Raziel*. Elements from *The Magical Calendar*, astrological seals by Robert Turner's 1656 translation of Paracelsus's *Archidoxes of Magic*, and repeated mentions of guns and the year 1641 indicate that this portion was written in the later half of the seventeenth century.*[15]*[16] Traditions of Paul communicating with heavenly powers are almost as old as Christianity itself, as seen in some interpretations of 2 Corinthians 12:2-4 and the apocryphal *Apocalypse of Paul*. The *Ars Paulina* is in turn divided into two books, the first detailing twenty-four angels aligned with the twenty-four hours of the day, the second (derived more from the *Heptameron*) detailing the 360 spirits of the degrees of the zodiac.*[16]

13.4 *Ars Almadel*

Mentioned by Trithemius and Weyer, the latter of whom claimed an Arabic origin for the work. A 15th-century copy is attested to by Robert Turner, and Hebrew copies were discovered in the 20th century. The *Ars Almadel* instructs the magician on how to create a wax tablet with specific designs intended to contact angels via *scrying*.*[17]*[18]

13.5 *Ars Notoria*

The oldest known portion of the *Lemegeton*, the *Ars Notoria* (or *Notory Art*) was first mentioned by Michael Scot in 1236 (and thus was written earlier). The *Ars Notoria* contains a series of prayers (related to those in *The Sworn Book of Honorius*) intended to grant *eidetic memory* and instantaneous learning to the magician. Some copies and editions of the *Lemegeton* omit this work entirely;*[19]*[20] A. E. Waite ignores it completely when describing the *Lemegeton*.*[4] It is also known as the *Ars Nova*.

13.6 Editions and translations

- Arthur Edward Waite, *The Book of Black Magic and of Pacts* (1898). Later republished as *The Secret Tradition in Goetia*, includes large portions of the *Lemegeton*, particularly the *Goetia*.*[9]
- Mathers, S. L. MacGregor (trans.), Crowley, A. (ed.), *The Goetia: The Lesser Key of Solomon the King* (1904). 1995 reprint: ISBN 0-87728-847-X.
- Shah, Idries, *The Secret Lore of Magic*, (1970). Contains portions of *Ars Almadel* and split sections the *Ars Goetia*, missing large portions of the rituals involved.*[9]
- de Laurence, L. W. (1916); 1942 reprint: ISBN 978-0-7661-0776-2; 2006 reprint: ISBN 978-1-59462-200-7. A plagiarism of the Mathers/Crowley edition.*[21]
- White, Nelson and Anne. *Lemegeton; Clavicula Salomonis: or The Complete Lesser Key of Solomon The King*, (1979). Noted by Peterson to be “almost totally unreadable”.*[9]
- Henson, Mitch (1999), ISBN 978-0-9672797-0-1. Noted by Peterson to be “uncritical and indiscriminate in its use of source material”.*[9]

- Runyon, Carroll, *The Book of Solomon's Magick*; (1996). Targeted more toward practicing magicians than academics, claims that the demons were originally derived from Mesopotamian mythology. * [22]
- Peterson, Joseph H. *The Lesser Key of Solomon: Lemegeton Clavicula Salomonis* (2001), ISBN 978-1-57863-220-6. Considered “the definitive version” * [23] and “the standard edition” . * [24]
- Skinner, Stephen & Rankine, David, *The Goetia of Dr Rudd: The Angels and Demons of Liber Malorum Spirituum Seu Goetia (Sourceworks of Ceremonial Magic)*. Golden Hoard Press, (2007). ISBN 978-0-9547639-2-3

13.7 Notes

- [1] The *Clavicula Salomonis*, or *Key of Solomon* is an earlier text referring to different material.
- [2] The latter republished spuriously as a purported Fourth Book of Agrippa.

13.8 References

- [1] *Lemegeton Clavicula Salomonis: The Lesser Key of Solomon, Detailing the Ceremonial Art of Commanding Spirits Both Good and Evil*; ed. Joseph H. Peterson; Weiser Books, Maine; 2001. p.xi-xvii
- [2] *The Goetia of Dr Rudd*; Thomas Rudd, Eds. Stephen Skinner & David Rankine; 2007, Golden Hoard Press. p. 399.
- [3] Rudd, Ed. Skinner & Rankine; p.14-19
- [4] *The Book of Ceremonial Magic*, Part I, Chapter III, section 2: “The Lesser Key of Solomon”; Arthur Edward Waite; London, 1913; available online at The Internet Sacred Text Archive, (direct link to section).
- [5] Rudd, Ed. Skinner & Rankine; pp. 31-43
- [6] Rudd, Ed. Skinner & Rankine; p.82
- [7] A Book of the Office of Spirits; John Porter, Trans. Frederick Hockley, Ed. Colin D. Campbell; Teitan Press, 2011. p. xiii-xvii
- [8] Rudd, Ed. Skinner & Rankine; p. 71
- [9] Peterson, 2001, p.xviii-xx
- [10] Peterson, 2001, p.40
- [11] First footnote by Joseph H. Peterson to Trithemius's *The art of drawing spirits into crystals*
- [12] *The Magical Calendar*; Johann Baptist Grossschedel, trans. and ed. Adam McLean; Phanes Press, 1994. P. 35.
- [13] Peterson, 2001, p.xv.
- [14] Rudd, ed. Skinner & Rankine; p.53-57
- [15] Peterson, 2001, p. xv-xvi
- [16] Rudd, ed. Skinner & Rankine; pp. 57-59
- [17] Peterson, 2001, p. xvi
- [18] Rudd, ed. Skinner & Rankine; p.59-60
- [19] Peterson, 2001, p. xvii
- [20] Rudd, ed. Skinner & Rankine; p.60-63.
- [21] Rudd, ed. Skinner & Rankine; p.50,
- [22] Rudd, ed. Skinner & Rankine; p.51-52
- [23] Rudd, ed. Skinner & Rankine; p.8
- [24] Rudd, ed. Skinner & Rankine; p.52

13.9 External links

- J. B. Hare, online edition (2002, sacred-texts.com)
- A correspondence chart of demons mentioned in the *Key* by rank, planet, etc.
- The Goetia at About.com
- Demon Sigils (Seals) from The Goetia at About.com
- Esotericarchives.com
- The Study of Solomonic Magic in English

Chapter 14

Limited hangout

A **limited hangout** or **partial hangout** is, according to former special assistant to the Deputy Director of the Central Intelligence Agency Victor Marchetti, “spy jargon for a favorite and frequently used gimmick of the clandestine professionals. When their veil of secrecy is shredded and they can no longer rely on a phony cover story to misinform the public, they resort to admitting—sometimes even volunteering—some of the truth while still managing to withhold the key and damaging facts in the case. The public, however, is usually so intrigued by the new information that it never thinks to pursue the matter further.” ^[1]^[2]

14.1 Modified limited hangout

In a March 22, 1973 meeting between Richard Nixon, John Dean, John Ehrlichman, John Mitchell, and H. R. Haldeman, Ehrlichman incorporated the term into a new and related one, “**modified limited hangout**”. ^[3]^[4]

The phrase was coined in the following exchange: ^[5]

Before this exchange, the discussion captures Nixon outlining to Dean the content of a report that Dean would create, laying out a misleading view of the role of the White House staff in events surrounding the Watergate burglary. In Ehrlichman's words: “And the report says, 'Nobody was involved,'”. The document would then be shared with the United States Senate Watergate Committee investigating the affair. The report would serve the administration's goals by protecting the President, providing documentary support for his false statements should information come to light that contradicted his stated position. Further, the group discusses having information on the report leaked by those on the Committee sympathetic to the President, to put exculpatory information into the public sphere. ^[5]

The phrase has been cited as a summation of the strategy of mixing partial admissions with misinformation and resistance to further investigation, and is used in political commentary to accuse people or groups of following a Nixon-like strategy. ^[6]

Writing in *The Washington Post*, Mary McGrory described a statement by Pope John Paul II regarding sexual abuse by priests as a “modified, limited hangout”. ^[7]

14.2 See also

- Half-truth

14.3 References

- [1] Victor Marchetti (August 14, 1978) *The Spotlight*
- [2] “720 F2d 631 Hunt v. Liberty Lobby Dc” . OpenJurist. 1983-11-28. Retrieved 2016-07-13.
- [3] Frost/Nixon: The Complete Interviews. David Frost, Richard Nixon. Paradine Television, 1977.
- [4] Sfire, William (26 March 1989). “On Language; In Nine Little Words” . *New York Times*. Retrieved 23 June 2013.

- [5] “Transcript of a recording of a meeting among the president, John Dean, John Erlichman, H. R. Haldeman, and John Mitchell on March 22, 1973 from 1:57 to 3:43 p.m.” . History and Politics Out Loud. Retrieved 2006-08-27.
- [6] Carrol, Jon (2002-05-01). “The Richard Nixon playbook” . San Francisco Chronicle. Retrieved 2006-08-27.
- [7] McGrory, Mary (2002-04-25). “From Rome, A 'Limited Hangout'". *The Washington Post*. Washington, D.C. p. A29. Retrieved 2010-04-30.

Chapter 15

Limonana

Limonana (Arabic: **ليمون نعناع**; Hebrew: **לימוןנענע**) is a type of **lemonade** made from freshly-squeezed **lemon** juice and **spearmint** leaves that forms a popular summer drink in **Egypt**, **Israel**, **Cyprus**, **Jordan**, **Lebanon**, and **Syria**.^[1]

15.1 Etymology

Limonana is a **portmanteau** of the **Arabic** and **Hebrew** words *limon* (Arabic: **ليمون**, Hebrew: **לימון**, meaning **lemon**) and *nana* (Arabic: **نعناع**, Hebrew: **נענע**, meaning **mint**),^[1] referring to its two main ingredients, freshly-squeezed lemon juice and spearmint leaves.^[2]

15.2 History

Limonana may have originated in Syria or Turkey.^[3] In Israel, the name came from an advertising campaign conducted in the early 1990s. At that time, public-bus advertising was in its infancy in Israel. The Fogel Levin advertising agency undertook a bus-only campaign to prove the effectiveness of this new medium. Fogel Levin advertised a soft drink called Limonana and printed its ads through the *Galgalei Zahav* (Wheels of Gold) company.^[4] The ads, describing the drink as a blend of lemon and mint, reported, “Rabinowitz drinks Limonana” and, “**Ohana** drinks Limonana”,^[5] referring to celebrities of the time. The ad campaign created a **buzz**^[4] and consumers flocked to stores and kiosks to try the new flavor. Two weeks into the campaign, with consumers and stores clamoring for the product, the advertising agency admitted that no such drink existed.^[6]^[7] Spurred by customer demand, first restaurants and then soft drink manufacturers began to produce the flavor combination.^[7]

It is on the menu at **Aroma Espresso Bars** in **New York**, **Florida**, and **Canada**.^[7]

Limonana can be prepared as a lemonade, a smoothie,^[2] and a slush.^[8] It has also been incorporated into sorbet^[9] and yogurt.^[10]

15.3 See also

- **Israeli cuisine**
- **List of lemonade topics**
- **List of lemon dishes and beverages**

15.4 References

[1] “Limonana: Not your average lemonade” . Zomppa. 29 August 2011. Retrieved 28 May 2012.

[2] “Ice Limonana – Mint lemonade, the drink of the Israeli summer” . Cafe Liz. 4 July 2010. Retrieved 28 May 2012.



Limonana served in Damascus, Syria.

- [3] “Mint Lemonade” . ifood.tv. 2009.
- [4] הפלאפל ברדיו עובד, הפרסום פחות [The Falafel on Radio Works, The Advertising Less So] (in Hebrew). tapuz.co.il. 31 May 2010. Retrieved 28 May 2012.
- [5] Sharon-Rivlin, Vered (14 October 1997). מה בולט ושורץ בגוש דן [What is Prominent and Swarming in Gush Dan?]. *Globes* (in Hebrew). Archived from the original on 4 October 2013. Retrieved 28 May 2012.
- [6] Siegal, Lilach (29 May 2001). לימונענע וירטואלית [Virtual Limonana]. *The Marker* (in Hebrew). Retrieved 28 May 2012.
- [7] Martinelli, Katherine (11 July 2011). “Limonana: Sparkling Summer” . *Jewish Daily Forward*. Retrieved 28 May 2012.
- [8] “The Frozen Seat” . Da’at Travel. Retrieved 28 May 2012.
- [9] Moskowitz, Laurie (11 January 2011). “The New Basics” . *Jewish Telegraphic Agency*. Archived from the original on 7 June 2012. Retrieved 28 May 2012.

- [10] טרה משיקה משקאות יוגורט פרי עם תוספים בריאותיים [Tara Produces Fruit Yogurt Drinks With Healthy Additives] (in Hebrew). Ynet. 18 June 2002. Retrieved 28 May 2012.

Chapter 16

Lingchi

“Death by a thousand cuts” redirects here. For other uses, see [Death by a thousand cuts \(disambiguation\)](#).



An 1858 illustration from the French newspaper *Le Monde Illustré*, of the lingchi execution of a French missionary, *Auguste Chapdelaine*, in China. In fact, Chapdelaine died from physical abuse in prison, and was beheaded after death.

Lingchi (凌迟; 凌遲; *língchí*; *ling-ch'ih*, alternately transliterated *ling chi* or *leng t'che*), translated variously as **death by a thousand cuts** (杀千刀/千刀万剐; 殺千刀/千刀萬剮; *shā qiān dāo/qiāndāo wànguǎ*), the **slow process**, the **lingering death**, or **slow slicing**, was a form of torture and **execution** used in **China** from roughly 900 CE until it was banned in 1905. It was also used in **Vietnam**. In this form of execution, a knife was used to methodically remove portions of the body over an extended period of time, eventually resulting in death.

Lingchi was reserved for crimes viewed as especially severe, such as high treason, patricide, or matricide. Some Westerners were executed in this manner. Even after the practice was outlawed, the concept itself has still appeared across many types of media.

16.1 Etymology

The term *lingchi* first appeared in a line in Chapter 28 of the classical philosophical text *Xunzi*. The line originally described the difficulty in travelling in a horse-drawn carriage on mountainous terrain.*[1] Later on, it was used to describe the prolonging of a person's agony when the person is being killed.*[2]

16.2 Description

The process involved tying the condemned prisoner to a wooden frame, usually in a public place. The flesh was then cut from the body in multiple slices in a process that was not specified in detail in Chinese law, and therefore most likely varied. The punishment worked on three levels: as a form of public humiliation, as a slow and lingering death, and as a punishment after death.

According to the Confucian principle of filial piety, to alter one's body or to cut the body are considered unfilial practices. *Lingchi* therefore contravenes the demands of filial piety. In addition, to be cut to pieces meant that the body of the victim would not be “whole” in spiritual life after death. This method of execution became a fixture in the image of China among some Westerners.*[3]

Lingchi could be used for the torture and execution of a living person, or applied as an act of humiliation after death. It was meted out for major offences such as high treason, mass murder, patricide/matricide or the murder of one's master or employer.*[4] Emperors used it to threaten people and sometimes ordered it for minor offences.*[5]*[6] There were forced convictions and wrongful executions.*[7]*[8] Some emperors meted out this punishment to the family members of their enemies.*[9]*[10]*[11]*[12]

While it is difficult to obtain accurate details of how the executions took place, they generally consisted of cuts to the arms, legs, and chest leading to amputation of limbs, followed by decapitation or a stab to the heart. If the crime was less serious or the executioner merciful, the first cut would be to the throat causing death; subsequent cuts served solely to dismember the corpse.

Art historian James Elkins argues that extant photos of the execution clearly show that the “death by division” (as it was termed by German criminologist Robert Heindl) involved some degree of dismemberment while the subject was living.*[13] Elkins also argues that, contrary to the apocryphal version of “death by a thousand cuts”, the actual process could not have lasted long. The condemned individual is not likely to have remained conscious and aware (if even alive) after one or two severe wounds, so the entire process could not have included more than a “few dozen” wounds.

In the Yuan dynasty, 100 cuts were inflicted*[14] but by the Ming dynasty there were records of 3,000 incisions.*[15]*[16] It is described as a fast process lasting no longer than 15 to 20 minutes.*[17] Available photographic records*[18]*[19] seem to prove the speed of the event as the crowd remains consistent across the series of photographs. Moreover, these photographs show a striking contrast between the stream of blood that soaks the left flank of the victim and the lack of blood on the right side, possibly showing that the first or the second cut has reached the heart.*[20]*[21] The *coup de grâce* was all the more certain when the family could afford a bribe to have a stab to the heart inflicted first.*[22] Some emperors ordered three days of cutting*[23]*[24] while others may have ordered specific tortures before the execution,*[25] or a longer execution.*[26]*[27]*[28] For example, records showed that during Yuan Chonghuan's execution, Yuan was heard shouting for half a day before his death.*[29]

The flesh of the victims may also have been sold as medicine.*[30] As an official punishment, death by slicing may also have involved slicing the bones, cremation, and scattering of the deceased's ashes.

16.3 Western perceptions

The Western perception of *lingchi* has often differed considerably from the actual practice, and some misconceptions persist to the present. The distinction between the sensationalised Western myth and the Chinese reality was noted by Westerners as early as 1895. That year, Australian traveller George Ernest Morrison, who claimed to have witnessed an execution by slicing, wrote that “*lingchi* [was] commonly, and quite wrongly, translated as ‘death by slicing into 10,000 pieces’ — a truly awful description of a punishment whose cruelty has been extraordinarily misrepresented... The mutilation is ghastly and excites our horror as an example of barbarian cruelty; but it is not cruel, and need not excite our horror, since the mutilation is done, not before death, but after.”*[31]

According to apocryphal lore, *lingchi* began when the torturer, wielding an extremely sharp knife, began by putting out the eyes, rendering the condemned incapable of seeing the remainder of the torture and, presumably, adding considerably to the psychological terror of the procedure. Successive rather minor cuts chopped off ears, nose, tongue, fingers, toes and genitals before proceeding to cuts that removed large portions of flesh from more sizable parts, e.g., thighs and shoulders.

The entire process was said to last three days, and to total 3,600 cuts. The heavily carved bodies of the deceased were then put on a parade for a show in the public.*[32] Some victims were reportedly given doses of opium to alleviate suffering.

John Morris Roberts, in *Twentieth Century: The History of the World, 1901 to 2000* (2000), writes “the traditional punishment of death by slicing... became part of the western image of Chinese backwardness as the 'death of a thousand cuts.'” Roberts then notes that slicing “was ordered, in fact, for K'ang Yu-Wei, a man termed the 'Rousseau of China', and a major advocate of intellectual and government reform in the 1890s.”*[33]

Although officially outlawed by the government of the Qing dynasty in 1905,*[34] *lingchi* became a widespread Western symbol of the Chinese penal system from the 1910s on, and in Zhao Erfeng's administration.*[35] Three sets of photographs shot by French soldiers in 1904–05 were the basis for later mythification. The abolition was immediately enforced, and definite: no official sentences of *lingchi* were performed in China after April 1905.

Regarding the use of opium, as related in the introduction to Morrison's book, Meyrick Hewlett insisted that “most Chinese people sentenced to death were given large quantities of opium before execution, and Morrison avers that a charitable person would be permitted to push opium into the mouth of someone dying in agony, thus hastening the moment of deace.” At the very least, such tales were deemed credible to British officials in China and other Western observers.

16.4 History

Lingchi existed under the earliest emperors, although similar but less cruel tortures were often prescribed instead. Under the reign of Qin Er Shi, the second emperor of the Qin dynasty, multiple tortures were used to punish officials.*[36]*[37] The arbitrary, cruel, and short-lived Liu Ziye was apt to kill innocent officials by *lingchi*.*[38] Gao Yang killed only six people by this method,*[39] and An Lushan killed only one man.*[40]*[41] *Lingchi* was known in the Five Dynasties period (907–960 CE); but, in one of the earliest such acts, Shi Jingtang abolished it.*[42] Other rulers continued to use it.

The method was prescribed in the Liao dynasty law codes,*[43] and was sometimes used.*[44] Emperor Tianzuo often executed people in this way during his rule.*[45] It became more widely used in the Song dynasty under Emperor Renzong and Emperor Shenzong.

Another early proposal for abolishing *lingchi* was submitted by Lu You (1125–1210) in a memorandum to the imperial court of the Southern Song dynasty. Lu You's elaborate argument against *lingchi* was piously copied and transmitted by generations of scholars, among them influential jurists of all dynasties, until the late Qing dynasty reformist Shen Jiaben (1840–1913) included it in his 1905 memorandum that obtained the abolition. This anti-*lingchi* trend coincided with a more general attitude opposed to “cruel and unusual” punishments (such as the exposure of the head) that the Tang dynasty had not included in the canonic table of the Five Punishments, which defined the legal ways of punishing crime. Hence the abolitionist trend is deeply ingrained in the Chinese legal tradition, rather than being purely derived from Western influences.

Under later emperors, *lingchi* was reserved for only the most heinous acts, such as treason,*[46]*[47] a charge often dubious or false, as exemplified by the deaths of Liu Jin, a Ming dynasty eunuch, and Yuan Chonghuan, a Ming dynasty general. Reports from Qing dynasty jurists such as Shen Jiaben show that executioners' customs varied, as the regular way to perform this penalty was not specified in detail in the penal code.

Lingchi was also known in Vietnam, notably being used as the method of execution of the French missionary Joseph Marchand, in 1835, as part of the repression following the unsuccessful Lê Văn Khôi revolt.

An 1858 account by *Harper's Weekly* claimed the martyr Auguste Chapdelaine was killed by *lingchi*; in fact he was beheaded after death.

As Western countries moved to abolish similar punishments, some Westerners began to focus attention on the methods of execution used in China. As early as 1866, the time when Britain itself moved to abolish its own cruel method of hanging, drawing, and quartering, Thomas Francis Wade, then serving with the British diplomatic mission in China,



Execution of Joseph Marchand in Vietnam, 1835.

unsuccessfully urged the abolition of *lingchi*.

Lingchi remained in the Qing dynasty's code of laws for persons convicted of high treason and other serious crimes, but the punishment was abolished as a result of the 1905 revision of the Chinese penal code by Shen Jiaben. * [48] * [49] * [50]

16.5 Published accounts

- Sir Henry Norman, *The People and Politics of the Far East* (1895). Norman was a widely travelled writer and photographer whose collection is now owned by the University of Cambridge. Norman gives an eyewitness account of various physical punishments and tortures inflicted in a magistrate's court (*yamen*) and of the execution by beheading of 15 men. He gives the following graphic account of a *lingchi* execution but does not claim to have witnessed such an execution himself. "[The executioner] grasping handfuls from the fleshy parts of the body such as the thighs and breasts slices them away... the limbs are cut off piecemeal at the wrists and ankles, the elbows and knees, shoulders and hips. Finally the condemned is stabbed to the heart and the head is cut off." * [51]
- George Ernest Morrison, *An Australian in China* (1895) differs from some other reports in stating that most *lingchi* mutilations are in fact made *post-mortem*. Morrison wrote his description based on an account related by a claimed eyewitness: "The prisoner is tied to a rude cross: he is invariably deeply under the influence of opium. The executioner, standing before him, with a sharp sword makes two quick incisions above the eyebrows, and draws down the portion of skin over each eye, then he makes two more quick incisions across the breast, and in the next moment he pierces the heart, and death is instantaneous. Then he cuts the body in pieces; and the degradation consists in the fragmentary shape in which the prisoner has to appear in heaven." * [52]
- Tienstin (Tianjin), *The China Year Book* (1927), p. 1401, contains contemporary reports from fighting in Guangzhou (Canton) between the Nanjing government and Communist forces. Stories of various atrocities are related, including accounts of *lingchi*. There is no mention of opium, and these cases appear to be government propaganda.
- *The Times*, (9 December 1927), a journalist reported from the city of Guangzhou (Canton) that the Communists were targeting Christian priests and that "It was announced that Father Wong was to be publicly executed by the slicing process."
- George Roerich, "Trails to Inmost Asia" (1931), p. 119, relates the story of the assassination of Yang Tseng-hsin, Governor of Sinkiang in July 1928, by the bodyguard of his foreign minister Fan Yao-han. Fan was seized, and he and his daughter were both executed by *lingchi*, the minister made to watch his daughter's execution first. Roerich was not an eyewitness to this event, having already returned to India by the date of the execution.
- George Ryley Scott, *History of Torture* (1940) claims that many were executed this way by the Chinese Communist insurgents; he cites claims made by the Nanking government in 1927. It is perhaps uncertain whether these claims were anti-communist propaganda. Scott also uses the term "the slicing process" and differentiates between the different types of execution in different parts of the country. There is no mention of opium. Riley's book contains a picture of a sliced corpse (with no mark to the heart) that was killed in Guangzhou (Canton) in 1927. It gives no indication of whether the slicing was done *post-mortem*. Scott claims it was common for the relatives of the condemned to bribe the executioner to kill the condemned before the slicing procedure began.

16.5.1 Photographs

The first Western photographs of *lingchi* were taken in 1890 by William Arthur Curtis of Kentucky in Guangzhou (Canton). * [53]

French soldiers stationed in Beijing had the opportunity to photograph three different *lingchi* executions in 1905:

- Wang Weiqin (王維勤), a former official who killed two families, executed on 31 October 1904. * [19] * [54]
- Unknown, reason unknown, possibly a young deranged boy who killed his mother, and was executed in January 1905. Photographs were published in various volumes of Georges Dumas' *Nouveau traité de psychologie*, 8 vols., Paris, 1930–43, and again nominally by Bataille (in fact by Lo Duca), who mistakenly appended abstracts of Fou-tchou-li's executions as related by Carpeaux (see below). * [55]

- Fou-tchou-li or Fuzhuli (符珠哩),* [56] a Mongol guard who killed his master, the Prince of the Aohan Banner of Inner Mongolia, and who was executed on 10 April 1905; as *lingchi* was to be abolished two weeks later, this was presumably the last attested case of *lingchi* in Chinese history,* [57] or said Kang Xiaoba (康小八)* [58] Photographs appeared in books by Matignon (1910), and Carpeaux (1913), the latter claiming (falsely) that he was present. Carpeaux's narrative was mistakenly, but persistently, associated with photographs published by Dumas and Bataille. Even related to the correct set of photos, Carpeaux's narrative is highly dubious; for instance, an examination of the Chinese judicial archives show that Carpeaux bluntly invented the execution decree. The proclamation is reported to state: “The Mongolian princes demand that the aforesaid Fou-Tchou-Le, guilty of the murder of Prince Ao-Han-Ouan, be burned alive, but the Emperor finds this torture too cruel and condemns Fou-Tchou-Li to slow death by *leng-tch-e* (different spelling of *lingchi*, cutting into pieces).” * [59]

Photographic material and other sources are available online at the Chinese Torture Database (Iconographic, Historical and Literary Approaches of an Exotic Representation) hosted by the Institut d'Asie Orientale (CNRS, France). * [60]

16.6 Popular references

Accounts of *lingchi* or the extant photographs have inspired or referenced in numerous artistic, literary, and cinematic media. Some works have attempted to put the process in a historical context; others, possibly due to the scarcity of detailed historical information, have attempted to extrapolate the details or present innovations of method that may be products of an author's creative license. Some of these descriptions may have influenced modern public perceptions of the historic practice.

16.6.1 Non-fiction

Susan Sontag mentions the 1905 case in *Regarding the Pain of Others* (2003). One reviewer wrote that though Sontag includes no photographs in her book – a volume about photography – “she does tantalisingly describe a photograph that obsessed the philosopher Georges Bataille, in which a Chinese criminal, while being chopped up and slowly flayed by executioners, rolls his eyes heavenwards in transcendent bliss.” * [61]

The philosopher Georges Bataille wrote about *lingchi* in *L'expérience intérieure* (1943) and in *Le coupable* (1944). He included five pictures in his *The Tears of Eros* (1961; translated into English and published by City Lights in 1989). * [62] Historians Timothy Brook, Jérôme Bourgon and Gregory Blue, criticised Bataille for his language, mistakes and dubious content. * [63] * [64]

16.6.2 Literature

In the novel *Flashman and the Dragon* by George MacDonald Fraser, Sir Harry Flashman describes a prisoner being bound tightly in a thin wire mesh through which nubs of flesh protrude. These are then cut off by the torturer with a sharp razor. In order to kill the prisoner, the razor is run quickly over many nubs of flesh at once. Barry Hughart outlines a similar method in his fantasy-historical novels set in China.

In the novel *Dream of the Red Chamber* by Cao Xueqin, Wang Xifeng makes reference to the punishment in the proverb “A man that is sentenced to death by a thousand cuts will dare to pull the emperor off his horse.”

In the novel *The Journeyer* by Gary Jennings, an executioner explains to the main character, Marco Polo, that 1,000 pieces of paper are placed in a container, and a paper is drawn out to determine where the cut will be made. For this procedure, there are 333 designated body parts, and each part is represented three times, for a total of 999 slips of paper, with the 1,000th paper representing immediate death. In the case of a finger, if the first paper drawn denoted a particular finger, the digit would be removed at the first joint; the second time a paper is drawn indicating the same finger, another section to the next joint is amputated. The third paper related to the same finger would indicate final amputation. Jennings also fictionalises in the book that, in an extended form of the torture, the body parts and blood are fed to the condemned as his only nourishment.

In the 1965 novel *Farabeuf*, author Salvador Elizondo uses one of the 1905 *lingchi* photographs, along with the story of a 19th-century French surgeon, to explore eroticism, photography, and memory. Farabeuf appears both as a secret agent who witnessed and photographed the execution, and as obsessed with the use of torture as a form

of erotic ceremony. The reproduction of the 1905 photograph appears along the climax of his engulfing narrative, widely perceived as one of the main works of Mexican literature of the 1960s.

The “death by a thousand cuts” with reference to China is also mentioned in **Malcolm Bosse's** novel *The Examination*, **Amy Tan's** novel *The Joy Luck Club*, and **Robert van Gulik's** *Judge Dee* novels. The 1905 photos are mentioned in **Thomas Harris's** novel *Hannibal** [65] and **Julio Cortázar's** novel *Rayuela*. *Lingchi* is used in the context of alternate settings in **Mercedes Lackey's** novel *The Serpent's Shadow* and **Richard K. Morgan's** novel *Broken Angels*.

Mo Yan's novel *Sandalwood Death*, set during the **Boxer Rebellion**, devotes an entire chapter to a detailed narration of the slicing of **Qian Xiongfei** by executioner **Zhao Jia**.

16.6.3 Film

In the 1956 film *The Conqueror*, this execution was called the “slow death”. Three of the main characters threaten to see the punishment inflicted at different points in the story. The “slow death” as described in *The Conqueror* accords with the more sensationalistic depictions of *lingchi*, but with the added refinement that the victim's severed parts are to be fed to animals before him.

Death by *lingchi* is also portrayed or referenced in the films *The Sand Pebbles* (1966), *Carry On... Up the Khyber* (1968), *Fled* (1996), *A Chinese Torture Chamber Story 2* (1998), * [66] *Rush Hour 3* (2007), the BBC TV series *Robin Hood* (2006), and the short film *Assassin's Creed: Embers* (2011).

Death by *lingchi* is partially carried out in the anime version of a popular manga called “*Deadman Wonderland*”.

Inspired by the 1905 photos, Chinese artist **Chen Chien-jen** created a 25-minute film called *Lingchi*, which has generated some controversy.* [67]

16.6.4 Music

John Zorn composed a piece titled *Leng Tch'e*, which was recorded by his group **Naked City** and released in 1992. The album's cover art includes a photo from the January 1905 execution. There is also a Belgian grindcore band named *Leng Tch'e*.

16.6.5 Television

In the *Murdoch Mysteries* episode “Kung Fu Crabtree,” a Chinese man named **Wu Chang** confesses to the murder of a diplomat to protect his sister. He states at the end of the episode that he will be taken back to China “in a year or two” - the episode is set in 1901 - and subjected to “death by a thousand cuts.” **Wu** was accused of being a **Boxer**, despite actually being a democratic reformer loyal to the deposed **Guangxu Emperor**.

In *The 100* episode “Spacewalker”, **Lincoln** explains that **Finn's** punishment for killing 18 Grounders in a village massacre is that **Finn** must be tied to a stake, and slowly cut and stabbed all night long by the grieving families of those he killed, until eventually being left to die of his wounds. Since he killed 18, **Lincoln** explains, he must suffer the pain of 18 deaths. Though it is not mentioned that the punishment is derived from *Lingchi*, the structure of the punishment itself is very similar, and **Lincoln** does refer to it as “death by a thousand cuts”.

In the *Jessica Jones* episode “AKA 1,000 Cuts”, **Wendy Ross-Hogarth** explains to **Kilgrave** while patching him up that she can't get revenge on her ex-wife **Jeri** because “how do you avenge death by a thousand cuts?” After she finishes, **Kilgrave** orders her to kill **Jeri** with a literal death by a thousand cuts. She attempts to do so, but is stopped and killed by **Pam** before she can finish.

16.7 See also

- *Death by a Thousand Cuts* – a 2008 book that examines the practice of *lingchi*
- *Scaphism* – a similarly slow form of torturous execution
- *Waist chop*

16.8 Notes

- [1] Xun, Kuang (3rd century BCE). “28” . *Xunzi*. China. 三尺之岸而虛車不能登也，百仞之山任負車登焉，何則？陵遲故也。 Check date values in: `|date= (help)`
- [2] Shen, Jiaben (2006). 历代刑法考 [*Research on Judicial Punishments over the Dynasties*] (in Chinese). China: Zhonghua Book Company. ISBN 9787101014631.
- [3] Morrison, JM (2000), *Twentieth Century: The History of the World, 1901 to 2000*.
- [4] 清李毓昌命案于保业 [The Qing Dynasty Case of Li Yuchang] (in Chinese). Jimo: Jimo Cultural Network. 2006. Retrieved 25 May 2015.
- [5] Hongwu Emperor. 大誥 [*Letters Patent*]
- [6] 文秉 [Wen Bing]. 先撥志始 [Volume One of the History]
- [7] 王世貞 [Shizhen (1526–90)]. 弇山堂別集 [*Yanshan Hall Collection*], vol. 97
- [8] 劉若愚 [Liu Ruoyu (1584–?)]. 酌中志 [Discretion in Chi], vol. 2
- [9] " 沈万三家族覆灭记" [Destruction of the Shen Manzo family]. *Suzhou Magazine* (苏州杂志) (in Chinese). 25 May 2007. ISSN 1005-1651. Archived from the original on 27 December 2015.
- [10] Gu Yingtai (谷應泰) (1620–90). 明史紀事本末 [*Major Events in Ming History*] (in Chinese). 18.
- [11] 國朝典故·立閑齋錄 [*Ming Dynasty History*] (in Chinese).
- [12] " 太平天國.1" [Taiping.1]. *UDN* (in Chinese). 25 January 2010. Retrieved 27 December 2015.
- [13] Elkins, James, *The Object Stares Back: On the Nature of Seeing*, New York: Simon and Schuster, 1996
- [14] Guan, Hanqing. *The Injustice to Dou E*.
- [15] Deng, Zhicheng (鄧之誠). *Gu Dong Xu Ji* (骨董續記), vol. 2.
- [16] *Yu Qiao Hua Zheng Ben Mo* (漁樵話鄭本末)
- [17] Bourgon, Jérôme; Detrie, Muriel; Poulet, Régis (2004). Bourgon, Jérôme, ed. “Execution in Canton” . *Chinese Torture - Supplices Chinois* (in English and French). IAO: Institut d'Asie Orientale. Retrieved 25 May 2015.
- [18] Bourgon, Jérôme, ed. (2004). “Execution of Fu-zhu-li” . *Chinese Torture - Supplices Chinois* (in English and French). IAO: Institut d'Asie Orientale. Retrieved 25 May 2015.
- [19] Bourgon, Jérôme, ed. (2004). “Exécution de Wang Weiqin” [Execution of Wan Weiqin]. *Chinese Torture - Supplices Chinois* (in English and French). IAO: Institut d'Asie Orientale. Retrieved 25 May 2015.
- [20] *Lingchi C, 2nd cut (a)*, CNRS, 10 April 1905.
- [21] *Lingchi A, 2nd cut (breasts)*, CNRS, 31 October 1904.
- [22] " 狱中杂记" [Miscellaneous Records from Prison]. *National Digital Cultural Network* (in Chinese). Archived from the original on 2007-06-21.
- [23] Shen, Defu (沈德符). *Wan Li Ye Huo Bian* (萬曆野獲編), vol. 28.
- [24] Zhang, Wenlin (張文麟). *Duan Yan Gong Nian Pu* (端巖公年譜).
- [25] Death of the Taiwanese eunuch Lin Biao (台灣籍太監林表之死)
- [26] Yanbei Laoren (燕北老人). *Qingdai Shisan Chao Gongwei Mishi* (清代十三朝宮闈秘史).
- [27] Xu, Ke (徐珂). *Qing Bai Lei Chao* (清稗類鈔).
- [28] *Lingchi - The Most Dreaded Form of Execution (Enter with Caution)* (「凌遲」最駭人的死刑 5 (慎入)). Pixnet (22 April 2010). Retrieved 20 May 2012.
- [29] Ji, Liuqi (計六奇). *Ming Ji Bei Lue* (明季北略), vol. 5.
- [30] Ji, Liuqi (計六奇). *Ming Ji Bei Lue* (明季北略), vol. 15.

- [31] Morrison, George Ernest. Bourgon, Jerome; Detrie, Muriel; Poulet, Regis, eds. "Turandot". Lyon, FR: CNRS. Retrieved 30 July 2009.
- [32] "Death by a Thousand Cuts at Chinese Arts Centre 18th January to 23rd March". Manchester events guide. Retrieved 2009-07-30.
- [33] Roberts, p. 60, footnote 8.
- [34] "Abolishing 'Cruel Punishments': A Reappraisal of the Chinese Roots and Long-term Efficiency of the Xinzheng Legal Reforms". Journals.cambridge.org. 8 October 2003. Retrieved 30 July 2009.
- [35] Norbu, Jamyang, *From Darkness to Dawn*, Phayl
- [36] Sima, Qian (91 BCE). "87". *Records of the Grand Historian* (in Chinese). China. Check date values in: |date= (help)
- [37] Ban, Gu (82 CE). "23". *Book of Han* (in Chinese). Check date values in: |date= (help)
- [38] Shen, Yue (488 CE). "9". *Book of Song* (in Chinese). China. Check date values in: |date= (help)
- [39] Li, Baiyao (636 CE). "3". *Book of Northern Qi* (in Chinese). China. Check date values in: |date= (help)
- [40] Ouyang, Xiu (1060 CE). "215". *New Book of Tang* (in Chinese). China. Check date values in: |date= (help)
- [41] "中國歷史上幾次最著名的凌遲之刑" [Several of the Most Famous Lingchi Cases in Chinese History]. *Sina* (in Chinese). 2008. Archived from the original on 1 August 2009. Retrieved 11 October 2015.
- [42] Xue, Juzheng (974 CE). "147". *Old History of the Five Dynasties* (in Chinese). China. Check date values in: |date= (help)
- [43] Toqto'a (1344). "61". *History of Liao* (in Chinese). China.
- [44] Toqto'a (1344). "112-114". *History of Liao* (in Chinese). China.
- [45] Toqto'a (1344). "62". *History of Liao* (in Chinese). China.
- [46] Zhang, Tingyu (1739). "54". *History of Ming* (in Chinese). China.
- [47] 清华大学教授刘书林——中国第一汉奸曾国藩 Archived 13 August 2007 at the Wayback Machine.
- [48] Shen, Jiaben. *Ji Yi Wen Cun - Zou Yi - Shan Chu Lü Li Nei Zhong Fa Zhe* (寄篠文存·奏議·刪除律例内重法折).
- [49] Zhao, Erxun (1928). "118". *Draft History of Qing* (in Chinese). China.
- [50] Bourgon, Jerome; Detrie, Muriel; Poulet, Regis (11 February 2004). "Turandot: Chinese Torture / Supplice chinois". CNRS. Retrieved 30 July 2009.
- [51] Turandot: Chinese Torture/Supplice chinois. CNRS. Retrieved 20 May 2012.
- [52] "An Australian in China". Pratyeka. 25 August 2002. Retrieved 30 July 2009.
- [53] Bourgon, Jerome; Detrie, Muriel; Poulet, Regis. "Turandot: Chinese Torture/Supplice chinois". CNRS. Retrieved 30 July 2009.
- [54] *Essay*
- [55] *The complete set*
- [56] Turandot: Chinese Torture/Supplice chinois. CNRS. Retrieved 20 May 2012.
- [57] Bourgon, Jerome; Detrie, Muriel; Poulet, Regis. "Complete set". CNRS. Retrieved 30 July 2009.
- [58] 史学研究向下延伸的道路能走多久 mm 读《狼烟北平》有感. Sohu. Retrieved 20 May 2012. Archived 16 July 2011 at the Wayback Machine.
- [59] Walker, Linda Marie. "Journal: coup de grâce (#1)". VA. Retrieved 30 July 2009.
- [60] Bourgon, Jerome; Detrie, Muriel; Poulet, Regis. "Turandot: Chinese Torture/Supplice chinois". CNRS. Retrieved 30 July 2009.
- [61] Conrad, Peter (3 August 2003). "Observer review: Regarding the Pain of Others by Susan Sontag". London: The Guardian. Retrieved 30 July 2009.
- [62] York, David (August 2003), "Flesh And Consciousness: George Bataille and the Dionysian" (PDF), *JCRT*.

- [63] Bourgon, Jerome; Detrie, Muriel; Poulet, Regis. “Turandot: Chinese Torture/Supplice chinois” . CNRS. Retrieved 30 July 2009..
- [64] Brook, Timothy; Bourgon, Jérôme; Blue, Gregory (2008), “6. George Bataille's Interpretation” , *Death by a Thousand Cuts*, Cambridge, MA: Harvard University Press, pp. 222–42.
- [65] “Section I” , *Hannibal*, Hannotations, retrieved 30 July 2009
- [66] *Moon ching sap daai huk ying ji chek law ling jeung* on Internet Movie Database
- [67] “WirralNews” . IC network. Archived from the original on 17 March 2006. Retrieved 30 July 2009.

16.9 References

- Brook, Timothy; Bourgon, Jérôme; Blue, Gregory (2008). *Death by a Thousand Cuts*. Cambridge, MA: Harvard University Press. ISBN 978-0-674-02773-2.
- Bourgon, Jérôme (2003). “Abolishing 'Cruel Punishments': A Reappraisal of the Chinese Roots and Long-Term Efficiency of the in Legal Reforms”. *Modern Asian Studies*. **37** (4): 851–62. doi:10.1017/S0026749X03004050.

Chapter 17

List of diseases of the honey bee

Diseases of the honey bee or abnormal hive conditions include:

17.1 Pests and parasites

17.1.1 *Varroa* mites



Varroa mite on a honey bee larva

Main article: [Varroa destructor](#)

Varroa destructor and *Varroa jacobsoni* are parasitic mites that feed on the bodily fluids of adult, pupal and larval bees. *Varroa* mites can be seen with the naked eye as a small red or brown spot on the bee's thorax. *Varroa* mites are carriers for many viruses that are damaging to bees. For example, bees infected during their development will often have visibly deformed wings.

Varroa mites have led to the virtual elimination of feral bee colonies in many areas, and are a major problem for kept bees in apiaries. Some feral populations are now recovering—it appears they have been naturally selected for *Varroa* resistance.

Varroa mites were first discovered in Southeast Asia in about 1904, but are now present on all continents except Australia. They were discovered in the United States in 1987, in New Zealand in 2000, and in Devon, United Kingdom in 1992.

These mites are generally not a problem for a strongly growing hive. When the hive population growth is reduced in preparation for winter or due to poor late summer forage, the mite population growth can overtake that of the bees and can then destroy the hive. Often a colony will simply abscond (leave as in a swarm, but leaving no population behind) under such conditions.

Varroa in combination with viral vectors and bacteria have been theoretically implicated in colony collapse disorder.

Treatment

A variety of treatments are currently marketed or practiced to attempt to control these mites. The treatments are generally segregated into chemical and mechanical controls.

Common chemical controls include “hard” chemicals such as Amitraz (marketed as Apivar ^[1]), fluvalinate (marketed as Apistan), and coumaphos (marketed as CheckMite). “Soft” chemical controls include thymol (marketed as ApiLife-VAR and Apiguard), sucrose octanoate esters (marketed as Sucroside), oxalic acid and formic acid (sold in gel packs as Mite-Away, ^[2] but also used in other formulations). According to the U.S. Environmental Protection Agency, when used in beehives as directed, these treatments kill a large proportion of the mites while not substantially disrupting bee behavior or life span. Use of chemical controls is generally regulated and varies from country to country. With few exceptions, they are not intended for use during production of marketable honey. ^[3]

Common mechanical controls generally rely on disruption of some aspect of the mites' lifecycle. These controls are generally intended not to eliminate all mites, but merely to maintain the infestation at a level which the colony can tolerate. Examples of mechanical controls include drone brood sacrifice (varroa mites are preferentially attracted to the drone brood), powdered sugar dusting (which encourages cleaning behavior and dislodges some mites), screened bottom boards (so any dislodged mites fall through the bottom and away from the colony), brood interruption and, perhaps, downsizing of the brood cell size. A device called the varroa mite control entrance (VMCE) is under development as of 2008. The VMCE works in conjunction with a screened bottom board, by dislodging varroa mites from bees as they enter and exit a hive. ^[4]

17.1.2 Acarine (tracheal) mites

Acarapis woodi is a small parasitic mite that infests the airways of the honey bee. The first known infestation of the mites occurred in the British Isles in the early 20th century. First observed on the Isle of Wight in 1904, ^[5] the mystery illness known as Isle of Wight Disease was not identified as being caused by a parasite until 1921. It quickly spread to the rest of Great Britain. It was regarded as having wiped out the entire native bee population of the British Isles (although later genetic studies have found remnants that did survive) and it dealt a devastating blow to British beekeeping. Brother Adam at the Buckfast Abbey developed a resistant hybrid bee known as the Buckfast bee, which is now available worldwide to combat acarine disease.

Diagnosis for tracheal mites generally involves the dissection and microscopic examination of a sample of bees from the hive.

Acarine mites, formerly known as tracheal mites, are believed to have entered the US in 1984, from Mexico.

Mature female acarine mites leave the bee's airway and climb out on a hair of the bee, where they wait until they can transfer to a young bee. Once on the new bee, they move into the airways and begin laying eggs.

Treatment

Acarine mites are commonly controlled with grease patties (typically made from one part vegetable shortening mixed with three to four parts powdered sugar) placed on the top bars of the hive. The bees come to eat the sugar and pick up traces of shortening, which disrupts the mite's ability to identify a young bee. Some of the mites waiting to transfer to a new host remain on the original host. Others transfer to a random bee—a proportion of which will die of other causes before the mite can reproduce.

Menthol, either allowed to vaporize from crystal form or mixed into the grease patties, is also often used to treat acarine mites.

17.1.3 Nosema disease

Nosema apis is a **microsporidian** that invades the intestinal tracts of adult bees and causes nosema disease, also known as nosemosis. *Nosema* infection is also associated with black queen cell virus. It is normally only a problem when the bees cannot leave the hive to eliminate waste (for example, during an extended cold spell in winter or when the hives are enclosed in a wintering barn). When the bees are unable to void (**cleansing flights**), they can develop **dysentery**.

Nosema disease is treated by increasing the ventilation through the hive. Some beekeepers treat hives with **antibiotics** such as **fumagillin**.

Nosemosis can also be prevented or minimized by removing much of the honey from the beehive, then feeding the bees on sugar water in the late fall. Sugar water made from refined sugar has lower ash content than flower nectar, reducing the risk of dysentery. Refined sugar, however, contains fewer nutrients than natural **honey**, which causes some controversy among beekeepers.

In 1996, a similar type of organism to *N. apis* was discovered on the Asian honey bee *Apis cerana* and subsequently named *Nosema ceranae*. This parasite apparently also infects the western honey bee.* [6]

Exposure to **corn** pollen containing genes for *Bacillus thuringiensis* (Bt) production may weaken the bees' defense against *Nosema*.* [7] In relation to feeding a group of bees with Bt corn pollen and a control group with non-Bt corn pollen: "in the first year, the bee colonies happened to be infested with parasites (microsporidia). This infestation led to a reduction in the number of bees and subsequently to reduced broods in the Bt-fed colonies, as well as in the colonies fed on Bt toxin-free pollen. The trial was then discontinued at an early stage. This effect was significantly more marked in the Bt-fed colonies. (The significant differences indicate an interaction of toxin and pathogen on the epithelial cells of the honeybee intestine. The underlying mechanism which causes this effect is unknown.)"

This study should be interpreted with caution given that no repetition of the experiment nor any attempt to find confounding factors was made. In addition, Bt toxin and transgenic Bt pollen showed no acute toxicity to any of the life stages of the bees examined, even when the Bt toxin was fed at concentrations 100 times that found in transgenic Bt pollen from maize.

17.1.4 Small hive beetle

Further information: **Small hive beetle**

Aethina tumida is a small, dark-colored beetle that lives in beehives. Originally from Africa, the first discovery of **small hive beetles** in the Western Hemisphere was made in **St. Lucie County, Florida**, in 1998. The next year, a specimen that had been collected from **Charleston, South Carolina**, in 1996 was identified, and is believed to be the index case for the United States.* [8] By December 1999, small hive beetles were reported in **Iowa, Maine, Massachusetts, Minnesota, New Jersey, Ohio, Pennsylvania, Texas, and Wisconsin**, and it was found in **California** by 2006.

The lifecycle of this beetle includes **pupation** in the ground outside of the hive. Controls to prevent ants from climbing into the hive are believed to also be effective against the hive beetle. Several beekeepers are experimenting with the use of **diatomaceous earth** around the hive as a way to disrupt the beetle's lifecycle. The diatoms abrade the insects' surfaces, causing them to dehydrate and die.



Comb slimed by hive beetle larvae: Hives infested at this level will drive out bee colonies.

Treatment

Several pesticides are currently used against the small hive beetle. The chemical **fipronil** (marketed as Combat Roach Gel * [9]) is commonly applied inside the corrugations of a piece of cardboard. Standard corrugations are large enough that a small hive beetle can enter the cardboard through the end, but small enough that honey bees cannot enter (thus are kept away from the pesticide). Alternative controls such as oil-based top-bar traps are also available, but they have had very little commercial success.

17.1.5 Wax moths

Main article: [Waxworm](#)

Galleria mellonella (greater wax moths) do not attack the bees directly, but feed on the **wax** used by the bees to build their **honeycomb**. Their full development to adults requires access to used brood comb or brood cell cleanings—these contain **protein** essential for the larval development, in the form of brood cocoons. The destruction of the comb will spill or contaminate stored honey and may kill bee larvae.

When honey supers are stored for the winter in a mild climate, or in heated storage, the wax moth larvae can destroy portions of the comb, though they will not fully develop. Damaged comb may be scraped out and replaced by the bees. Wax moth larvae and eggs are killed by freezing, so storage in unheated sheds or barns in higher latitudes is the only control necessary.

Because wax moths cannot survive a cold winter, they are usually not a problem for beekeepers in the northern U.S. or Canada, unless they survive winter in heated storage, or are brought from the south by purchase or migration of beekeepers. They thrive and spread most rapidly with temperatures above 30 °C (90 °F), so some areas with only



Wax moth (Aphomia sociella)—more often associated with bumble bees (Bombus sp.)

occasional days that are hot rarely have a problem with wax moths, unless the colony is already weak due to stress from other factors.

Control and treatment

A strong hive generally needs no treatment to control wax moths; the bees themselves kill and clean out the moth larvae and webs. Wax moth larvae may fully develop in cell cleanings when such cleanings accumulate thickly where they are not accessible to the bees.

Wax moth development in comb is generally not a problem with **top bar hives**, as unused combs are usually left in the hive during the winter. Since this type of hive is not used in severe wintering conditions, the bees are able to patrol and inspect the unused comb.

Wax moths can be controlled in stored comb by application of the aizawai variety of *Bacillus thuringiensis* spores by spraying. It is a very effective biological control and has an excellent safety record.

Wax moths can be controlled chemically with **paradichlorobenzene** (moth crystals or urinal disks). If chemical methods are used, the combs must be well-aired for several days before use. The use of **naphthalene** (mothballs) is discouraged because it accumulates in the wax, which can kill bees or contaminate honey stores. Control of wax moths by other means includes the freezing of the comb for at least 24 hours.

17.1.6 *Tropilaelaps*

Tropilaelaps clareae and *T. mercedesae* are considered threats to honeybees. Although they are not currently found in the US or Canada, these mites have the potential to inflict serious damage to colonies due to their rapid reproduction inside the hive.

17.2 Bacterial diseases

17.2.1 American foulbrood

Main article: [American foulbrood](#)

American foulbrood (AFB), caused by the spore-forming *Paenibacillus larvae** [11] (formerly classified as *Bacillus larvae* and *Paenibacillus larvae* ssp *larvae/pulvifaciens*), is the most widespread and destructive of the bee brood diseases. *P. larvae* is a rod-shaped bacterium. Larvae up to three days old become infected by ingesting spores present in their food. Young larvae less than 24 hours old are most susceptible to infection. Spores germinate in the gut of the larva and the vegetative bacteria begin to grow, taking nourishment from the larva. Spores will not germinate in larvae over three days old. Infected larvae normally die after their cell is sealed. The vegetative form of the bacterium will die, but not before it produces many millions of spores. American foulbrood spores are extremely resistant to desiccation and can remain viable for more than 40 years in honey and beekeeping equipment. Each dead larva may contain as many as 100 million spores. This disease only affects the bee larvae, but is highly infectious and deadly to bee brood. Infected larvae darken and die.

As with European foulbrood, research has been conducted using the 'Shook Swarm'* [12] method to control American foulbrood, "the advantage being that chemicals are not used" .

17.2.2 European foulbrood

Melissococcus plutonius is a bacterium that infects the midgut of bee larvae. European foulbrood is considered less serious than American foulbrood. *M. plutonius* is not a spore-forming bacterium, but bacterial cells can survive for several months on wax foundation. Symptoms include dead and dying larvae which can appear curled upwards, brown or yellow, melted or deflated with tracheal tubes more apparent, or dried out and rubbery.* [13]

European foulbrood is often considered a "stress" disease — dangerous only if the colony is already under stress for other reasons. An otherwise healthy colony can usually survive European foulbrood. Chemical treatment with oxytetracycline hydrochloride may control an outbreak of the disease, but honey from treated colonies could have chemical residues from the treatment. The "Shook Swarm" * [14] technique of bee husbandry can also effectively control the disease, with the advantage of avoiding the use of chemicals. Prophylactic treatments are not recommended as they lead to resistant bacteria.

17.3 Fungal diseases

17.3.1 Chalkbrood

Ascosphaera apis is a fungal disease that infests the gut of the larva. The fungus competes with the larva for food, ultimately causing it to starve. The fungus then goes on to consume the rest of the larva's body, causing it to appear white and 'chalky'.

Chalkbrood is most commonly visible during wet springs. Hives with chalkbrood can generally be recovered by increasing the ventilation through the hive.

17.3.2 Stonebrood

Stonebrood is a fungal disease caused by *Aspergillus fumigatus*, *Aspergillus flavus*, and *Aspergillus niger*. It causes mummification of the brood of a honey bee colony. The fungi are common soil inhabitants and are also pathogenic to other insects, birds, and mammals. The disease is difficult to identify in the early stages of infection. The spores of the different species have different colours and can also cause respiratory damage to humans and other animals. When bee larvae take in spores, they may hatch in the gut, growing rapidly to form a collar-like ring near the larval heads. After death, the larvae turn black and become difficult to crush, hence the name stonebrood. Eventually, the fungus erupts from the integument of the larvae and forms a false skin. In this stage, the larvae are covered with powdery fungal spores. Worker bees clean out the infected brood and the hive may recover depending on factors



The entrance to this beehive is littered with chalkbrood mummies that have been expelled from the hive by hygienic worker bees.

such as the strength of the colony, the level of infection, and hygienic habits of the strain of bees (variation in the trait occurs among different subspecies/races).

17.4 Viral diseases

17.4.1 Cripaviridae

Chronic bee paralysis virus

- *Syndrome 1* Abnormal trembling of the wings and body occurs. The bees cannot fly, and often crawl on the ground and up plant stems. In some cases, the crawling bees can be found in large numbers (1000+). The bees huddle together on the top of the cluster or on the top bars of the hive. They may have bloated abdomens due to distension of the honey sac. The wings are partially spread or dislocated.
- *Syndrome 2* Affected bees are able to fly, but are almost hairless. They appear dark or black and look smaller. They have a relatively broad abdomen. They are often nibbled by older bees in the colony and this may be the cause of the hairlessness. They are hindered at the entrance to the hive by the guard bees. A few days after infection, trembling begins. They then become flightless and soon die.*[15]*[16]

In 2008, the chronic bee paralysis virus was reported for the first time in *Formica rufa* and another species of ant, *Camponotus vagus*.*[17]

17.4.2 Dicistroviridae

Acute bee paralysis virus

Acute bee paralysis virus*[18] is considered to be a common infective agent of bees. It belongs to the family Dicistroviridae,*[19] as does the Israel acute paralysis virus, Kashmir bee virus, and the black queen cell virus.

It is frequently detected in apparently healthy colonies. Apparently, this virus plays a role in cases of sudden collapse of honey bee colonies infested with the parasitic mite *Varroa destructor*.^[20]

Israeli acute paralysis virus

A related virus^[19] described in 2004 is known as the Israeli acute paralysis virus (IAPV).^[21] The virus is named after the place where it was first identified—its place of origin is unknown. IAPV has been suggested as a marker associated with colony collapse disorder.^{[22][23]}

Kashmir bee virus

Kashmir bee virus^[24] is related to the preceding viruses.^[19] Recently discovered, it is currently only positively identifiable by a laboratory test. Little is known about it yet.^[25]

Black queen cell virus

Black queen cell virus^[26] causes the queen larva to turn black and die. It is thought to be associated with *Nosema*.^[27]

17.4.3 Cloudy wing virus

Cloudy wing virus is a little-studied, small, icosahedral virus commonly found in honey bees, especially in collapsing colonies infested by *Varroa destructor*, providing circumstantial evidence that the mite may act as a vector.^{[28][29][30]}

17.4.4 Sacbrood virus

A picornavirus-like causes sacbrood disease.^{[31][32]} Affected larvae change from pearly white to gray and finally black. Death occurs when the larvae are upright, just before pupation. Consequently, affected larvae are usually found in capped cells. Head development of diseased larvae is typically retarded. The head region is usually darker than the rest of the body and may lean toward the center of the cell. When affected larvae are carefully removed from their cells, they appear to be a sac filled with water. Typically, the scales are brittle but easy to remove. Sacbrood-diseased larvae have no characteristic odor.^{[10][33]}

17.4.5 Iflavirus

Deformed wing virus

Main article: [Deformed wing virus](#)

Deformed wing virus (DWV) is the causative agent of the wing deformities and other body malformations typically seen in honeybee colonies that are heavily infested with the parasitic mite *Varroa destructor*.^[34] DWV is part of a complex of closely related virus strains/species that also includes Kakugo virus, *Varroa destructor* virus 1^[35] and Egypt bee virus. This deformity can clearly be seen on the honeybee's wings in the image. The deformities are produced almost exclusively due to DWV transmission by *V. destructor* when it parasitizes pupae. Bees infected as adults remain symptom-free, although they do display behavioral changes and have reduced life expectancy. Deformed bees are rapidly expelled from the colony, leading to a gradual loss of adult bees for colony maintenance. If this loss is excessive and can no longer be compensated by the emergence of healthy bees, the colony rapidly dwindles and dies.

Kakugo virus

Kakugo virus is an iflavirus infecting bees; varroa mites may mediate its prevalence.^[36]

17.4.6 Iridoviridae

Invertebrate iridescent virus type 6

Applying proteomics-based pathogen screening tools in 2010, researchers announced they had identified a co-infection of an iridovirus;* [37] specifically invertebrate iridescent virus type 6 (IIV-6) and *Nosema ceranae* in all CCD colonies sampled.* [38] On the basis of this research, the *New York Times* reported the colony collapse mystery solved, quoting researcher Dr. Bromenshenk, a co-author of the study, "[The virus and fungus] are both present in all these collapsed colonies."*[39]*[40] Evidence for this association, however, remains minimal*[41] and several authors have disputed the original methodology used to associate CCD with IIV-6.*[42]*[43]

17.4.7 Secoviridae

Tobacco ringspot virus

The RNA virus tobacco ringspot virus, primarily a plant pathogen, can infect honeybees through infected pollen.* [44]

17.4.8 Lake Sinai virus

Lake Sinai virus (LSV) genomes were assembled and three main domains were discovered: Orf1, RNA-dependent RNA polymerase and capsid protein sequences. LSV1, LSV2, LSV3, LSV4, LSV5, and LSV6 are described.*[45] LSV are detected in bees, mites and pollen, only actively replicates in honey bees and mason bees (*Osmia cornuta*) and not in *Varroa* mites.*[46]

17.5 Dysentery

Dysentery is a condition resulting from a combination of long periods of inability to make cleansing flights (generally due to cold weather) and food stores which contain a high proportion of indigestible matter. As a bee's gut becomes engorged with feces that cannot be voided in flight as preferred by the bees, the bee voids within the hive. When enough bees do this, the hive population rapidly collapses and death of the colony results. Dark honeys and honeydews have greater quantities of indigestible matter.

Occasional warm days in winter are critical for honey bee survival; dysentery problems increase in likelihood during periods of more than two or three weeks with temperatures below 50 °F (10 °C). When cleansing flights are few, bees will often be forced out at times when the temperature is barely adequate for their wing muscles to function, and large quantities of bees may be seen dead in the snow around the hives. Colonies found dead in spring from dysentery will have feces smeared over the frames and other hive parts.

In very cold areas of North America and Europe, where honey bees are kept in ventilated buildings during the coldest part of winter, no cleansing flights are possible; under such circumstances, it is common for beekeepers to remove all honey from the hives and replace it with sugar water or high fructose corn syrup, which have nearly no indigestible matter.

17.6 Chilled brood

Chilled brood is not actually a disease, but can be a result of mistreatment of the bees by the beekeeper. It also can be caused by a pesticide hit that primarily kills off the adult population, or by a sudden drop in temperature during rapid spring buildup. The brood must be kept warm at all times; nurse bees will cluster over the brood to keep it at the right temperature. When a beekeeper opens the hive (to inspect, remove honey, check the queen, or just to look) and prevents the nurse bees from clustering on the frame for too long, the brood can become chilled, deforming or even killing some of the bees.

17.7 Pesticide losses

Honey bees are susceptible to many of the chemicals used for agricultural spraying of other insects and pests. Many pesticides are known to be toxic to bees. Because the bees forage up to several miles from the hive, they may fly into areas actively being sprayed by farmers or they may collect pollen from contaminated flowers.

Carbamate pesticides, such as carbaryl, can be especially pernicious since toxicity can take as long as two days to become evident, allowing infected pollen to be returned and distributed throughout the colony. Organophosphates and other insecticides are also known to kill honey bee clusters in treated areas.

Pesticide losses may be relatively easy to identify (large and sudden numbers of dead bees in front of the hive) or quite difficult, especially if the loss results from a gradual accumulation of pesticide brought in by the foraging bees. Quick-acting pesticides may deprive the hive of its foragers, dropping them in the field before they can return home.

Insecticides that are toxic to bees have label directions that protect the bees from poisoning as they forage. To comply with the label, applicators must know where and when bees forage in the application area, and the length of residual activity of the pesticide.

Some pesticide authorities recommend, and some jurisdictions require, that notice of spraying be sent to all known beekeepers in the area, so they can seal the entrances to their hives and keep the bees inside until the pesticide has had a chance to disperse. This, however, does not solve all problems associated with spraying and the label instructions should be followed regardless of doing this. Sealing honey bees from flight on hot days can kill bees. Beekeeper notification does not offer any protection to bees, if the beekeeper cannot access them, or to wild native or feral honey bees. Thus, beekeeper notification as the sole protection procedure does not really protect all the pollinators of the area, and is, in effect, a circumventing of the label requirements. Pesticide losses are a major factor in pollinator decline.

17.8 Colony collapse disorder

Main article: Colony collapse disorder

Colony collapse disorder (CCD) is a poorly understood phenomenon in which worker bees from a beehive or western honey bee colony abruptly disappear. CCD was originally discovered in Florida by David Hackenberg in western honey bee colonies in late 2006.*[47]

European beekeepers observed a similar phenomenon in Belgium, France, the Netherlands, Greece, Italy, Portugal, and Spain,*[48] and initial reports have also come in from Switzerland and Germany, albeit to a lesser degree.*[49] Possible cases of CCD have also been reported in Taiwan since April 2007.*[50]


Initial hypotheses were wildly different, including environmental change-related stresses,*[51] malnutrition, pathogens (i.e., disease*[52] including Israel acute paralysis virus*[53]*[54]), mites, or the class of pesticides known as neonicotinoids, which include imidacloprid, clothianidin, and thiamethoxam. Unproven and less credible theories include radiation from cellular phones or other man-made devices,*[55] and genetically modified crops with pest-control characteristics.*[56] In 2010, US researchers announced they had identified a co-infection of invertebrate iridescent virus type 6 (IIV-6) and *Nosema ceranae* in all CCD colonies sampled.*[57]

17.9 References

- [1] “Home” . *apivar.net*.
- [2] “NOD - Nature's Own Design” . *miteaway.com*.
- [3] Office of Pesticide Programs; US Environmental Protection Agency Formic Acid (214900) Fact Sheet (2005)
- [4] <http://www.sciencein africa.co.za/2008/october/debugging.htm>
- [5] Anderson, John; Rennie, John (1916). *Observations and experiments bearing on the “Island of Wight” disease*. Edinburgh: R. Grant & Son.
- [6] Ritter, Wolfgang *Nosema ceranae* Archived 14 February 2007 at the Wayback Machine. Albert Ludwigs University of Freiburg

- [7] “Effects of Bt maize pollen on the honeybee” . 2005-10-12. Archived from the original on 26 January 2007. Retrieved 2007-03-21.
- [8] Neumann P, Elzen PJ (2004). “The biology of the small hive beetle (*Aethina tumida*, Coleoptera: Nitidulidae): Gaps in our knowledge of an invasive species” . *Apidologie*. **35** (3): 229–247. doi:10.1051/apido:2004010.
- [9] “Combat Source Kill Max Gel Kills Large and Small Roaches” . *combatbugs.com*.
- [10] Shimanuki, Hachiro; Knox, David A. Diagnosis of Honey Bee Diseases USDA Archived 9 December 2006 at the Wayback Machine.
- [11] Genersch, E; Forsgren, E; Pentikäinen, J; Ashiralieva, A; Rauch, S; Kilwinski, J; Fries, I (March 2006). “Reclassification of *Paenibacillus* larvae subsp. *pulvifaciens* and *Paenibacillus* larvae subsp. larvae as *Paenibacillus* larvae without subspecies differentiation.” . *International Journal of Systematic and Evolutionary Microbiology*. **56** (Pt 3): 501–11. doi:10.1099/ijs.0.63928-0. PMID 16514018.
- [12] Controlling American Foulbrood in Honeybees By Shook Swarm Method
- [13] “European Foulbrood: A Bacterial Disease Affecting Honey Bee Brood” . *extension.org*.
- [14] “Shook Swarm and OTC Antibiotics for European Foulbrood Control” . *extension.org*.
- [15] Ribière M, Faucon J, Pépin M (2000). “Detection of chronic honey bee (*Apis mellifera* L.) paralysis virus infection: application to a field survey” (PDF). *Apidologie*. **31** (5): 567–77. doi:10.1051/apido:2000147.
- [16] “Chronic Bee Paralysis Virus” . *globalnet.co.uk*.
- [17] Detection of Chronic bee paralysis virus (CBPV) genome and its replicative RNA form in various hosts and possible ways of spread.
- [18] (TaxID 92444)
- [19]
- [20] Bakonyi T, Grabensteiner E, Kolodziejek J, et al. (December 2002). “Phylogenetic analysis of acute bee paralysis virus strains” . *Appl. Environ. Microbiol.* **68** (12): 6446–50. doi:10.1128/AEM.68.12.6446-6450.2002. PMC 134446 . PMID 12450876.
- [21] (TaxID 294365)
- [22] Fox, Maggie (2007-09-06). “New virus may be killing bees” . Reuters. Retrieved 2007-09-06.
- [23] Humberto F. Boncristiani; et al. “In vitro infection of pupae with IAPV suggests disturbance of transcriptional homeostasis in honey bees (*Apis mellifera*)”. *PLOS ONE*. **8**: e73429. doi:10.1371/journal.pone.0073429. PMC 3764161 . PMID 24039938.
- [24] (TaxID 68876)
- [25] Kashmir Bee Virus Apiculture Factsheet #230, Ministry of Agriculture and Lands, Government of British Columbia, Jul 2004, accessed Jan 2007
- [26] (TaxID 92395)
- [27] “Multiple Virus Infections in the Honey Bee and Genome Divergence of Honey Bee Viruses” . *usda.gov*.
- [28] Carreck, Norman L; Ball, Brenda V; Martin, Stephen J (2010). “The epidemiology of cloudy wing virus infections in honey bee colonies in the UK” . *Journal of Apicultural Research*. **49** (1): 66–71. doi:10.3896/ibra.1.49.1.09.
- [29] Gliński, Z.; Jarosz, J. (2001). “Infection and immunity in the honey bee *Apis mellifera*” . *Apiacta*. **36** (1): 12–24.
- [30] Cloudy Wing Virus Universal Protein Resource (UniProt); European Bioinformatics Institute (EBI), the Swiss Institute of Bioinformatics (SIB) and the Protein Information Resource (PIR)
- [31] Wu, CY; Lo, CF; Huang, CJ; Yu, HT; Wang, CH (2002). “The complete genome sequence of *Perina nuda* picorna-like virus, an insect-infecting RNA virus with a genome organization similar to that of the mammalian picornaviruses” . *Virology*. **294** (2): 312–323. doi:10.1006/viro.2001.1344. PMID 12009873.
- [32] Grabensteiner, E; Ritter, W; Carter, MJ; Davison, S; Pechhacker, H; Kolodziejek, J; Boecking, O; Derakhshifar, I; Moosbeckhofer, R; Licek, E; Nowotny, N (2001). “Sacbrood Virus of the Honeybee (*Apis mellifera*): Rapid Identification and Phylogenetic Analysis Using Reverse Transcription-PCR” . *Clinical and Diagnostic Laboratory Immunology*. **8** (1): 93–104. doi:10.1128/CDLI.8.1.93-104.2001. PMC 96016 . PMID 11139201.

- [33] Grabensteiner, Elvira; Ritter, Wolfgang; Carter, Michael J.; Davison, Sean; Pechhacker, Hermann; Kolodziejek, Jolanta; Boecking, Otto; Derakhshifar, Irmgard; Moosbeckhofer, Rudolf; Licek, Elisabeth; Nowotny, Norbert (2001). "Sacbrood Virus of the Honeybee (*Apis mellifera*): Rapid Identification and Phylogenetic Analysis Using Reverse Transcription-PCR" . *Clin Diagn Lab Immunol.* **8** (1): 93–104. doi:10.1128/CDLI.8.1.93-104.2001. PMC 96016 . PMID 11139201.
- [34] de Miranda, Joachim R.; Genersch, Elke (2010). "Deformed wing virus" . *Journal of Invertebrate Pathology.* **103**: S48–S61. doi:10.1016/j.jip.2009.06.012. PMID 19909976.
- [35] Juliette R. Ongus, Els C. Roode, Cornelis W. A. Pleij, Just M. Vlak and Monique M. van Oers The 5' non-translated region of *Varroa destructor* virus 1 (genus *Iflavirus*): structure prediction and IRES activity in *Lymantria dispar* cell J Gen Virol **87** (2006), 3397–3407; doi:10.1099/vir.0.82122-0
- [36] Tomoko Fujiyuki, Seii Ohka, Hideaki Takeuchi, Masato Ono, Akio Nomoto, and Takeo Kubo Prevalence and Phylogeny of Kakugo Virus, a Novel Insect Picorna-Like Virus That Infects the Honeybee (*Apis mellifera* L.), under Various Colony Conditions Journal of Virology, December 2006, p. 11528–11538, Vol. 80, No. 23
- [37] Williams, Trevor Iridoviridae Instituto de Ecología AC (INECOL) Mexico
- [38] Leal, Walter S.; Bromenshenk, Jerry J.; Henderson, Colin B.; Wick, Charles H.; Stanford, Michael F.; Zulich, Alan W.; Jabbour, Rabih E.; Deshpande, Samir V.; McCubbin, Patrick E. (2010). Leal, Walter S., ed. "Iridovirus and Microsporidian Linked to Honey Bee Colony Decline" . *PLoS ONE.* **5** (10): e13181. doi:10.1371/journal.pone.0013181. PMC 2950847 . PMID 20949138.
- [39] Kirk Johnson (2010-10-06). "Scientists and Soldiers Solve a Bee Mystery" . *The New York Times*.
- [40] Invertebrate iridescent virus type 6 (IIV-6) Universal Protein Resource (UniProt); European Bioinformatics Institute (EBI), the Swiss Institute of Bioinformatics (SIB) and the Protein Information Resource (PIR).
- [41] Tokarz, Rafal; Cadhla Firth; Craig Street; Diana Cox-Foster; W. Ian Lipkin (2011). "Lack of evidence for an Association between Iridovirus and Colony Collapse Disorder" . *PLoS ONE.* **6** (6): e21844. doi:10.1371/journal.pone.0021844. PMC 3128115 . PMID 21738798.
- [42] Foster, Leonard (2011). "Interpretation of data underlying the link between colony collapse disorder (CCD) and an invertebrate iridescent virus." . *Molecular & Cellular Proteomics.* **10** (3).
- [43] Knudsen, Giselle; Robert Chalkley (2011). "The Effect of Using an Inappropriate Protein Database for Proteomic Data Analysis" . *PLoS ONE.* **6** (6): e20873. doi:10.1371/journal.pone.0020873. PMC 3114852 . PMID 21695130.
- [44] Li, J. L.; Cornman, R. S.; Evans, J. D.; Pettis, J. S.; Zhao, Y.; Murphy, C.; Peng, W. J.; Wu, J.; Hamilton, M.; Boncristiani, H. F.; Zhou, L.; Hammond, J.; Chen, Y. P. (21 January 2014). "Systemic Spread and Propagation of a Plant-Pathogenic Virus in European Honeybees, *Apis mellifera*" . *MBio.* **5** (1): e00898–13–e00898–13. doi:10.1128/mBio.00898-13.
- [45] Daughenbaugh, Katie F.; et al. "Honey Bee Infecting Lake Sinai Viruses". *Viruses.* **7**: 3285–3309. doi:10.3390/v7062772.
- [46] Ravoet, Jorgen; et al. "Genome sequence heterogeneity of Lake Sinai Virus found in honey bees and Orf1/RdRP-based polymorphisms in a single host" . *Virus Research.* **201**: 67–72. doi:10.1016/j.virusres.2015.02.019.
- [47] "Honey Bee Die-Off Alarms Beekeepers, Crop Growers and Researchers" . Penn State University College of Agricultural Sciences. 2007-01-29.
- [48] Gaëlle Dupont, Les abeilles malades de l'homme, *Le Monde*, 29 August 2007 (French)
- [49] Petra Steinberger (2007-03-12). "Das spurlose Sterben" (in German). sueddeutsche.de.
- [50] Paul Molga, La mort des abeilles met la planète en danger, *Les Echos*, 20 August 2007 (French)
- [51] Amy Sahba (2007-03-29). "The mysterious deaths of the honeybees" . CNN Money. Retrieved 2007-04-04.
- [52] "Colony Collapse Disorder Working Group" .
- [53] JR Minkel (2007-09-07). "Mysterious Honeybee Disappearance Linked to Rare Virus" . *Science News.* Scientific American. Retrieved 2007-09-07.
- [54] Andrew C. Refkin (2007-09-07). "Virus Is Seen as Suspect in Death of Honeybees" . *The New York Times*. Retrieved 2007-09-07.
- [55] Geoffrey Lean & Harriet Shawcross (2007-04-15). "Are mobile phones wiping out our bees?". *The Independent*. Retrieved 2007-12-10.

- [56] “GE and bee Colony Collapse Disorder -- science needed!”. 2005-03-21. Retrieved 2007-03-23.
- [57] Leal, Walter S.; Bromenshenk, Jerry J.; Henderson, Colin B.; Wick, Charles H.; Stanford, Michael F.; Zulich, Alan W.; Jabbour, Rabih E.; Deshpande, Samir V.; McCubbin, Patrick E. (2010). Leal, Walter S., ed. “Iridovirus and Microsporidian Linked to Honey Bee Colony Decline” . *PLoS ONE*. **5** (10): e13181. doi:10.1371/journal.pone.0013181. PMC 2950847 . PMID 20949138.

17.10 Further reading

- Canadian Honey Council Essential Oils for Varroa, Tracheal, AFB Control
- Sammataro, Diana; et al. *The Beekeeper's Handbook*
- Morse, Roger (editor) *The ABC and XYZ of Beekeeping*

17.11 External links

- [Beekeeping page](#) at the University of Georgia, with a large section on Honey Bee Disorders
- [Apiculture Factsheets](#) at the British Columbia Ministry of Agriculture and Lands
- [BeeBase](#) at the Defra Food and Environment Research Agency in the UK
- [Kohala.net](#) Diseases and Afflictions of Honey Bees
- [Beediseases](#) Honey bee diseases website by Dr. Guido Cordoni.

Chapter 18

List of intelligence gathering disciplines

Main article: [Intelligence assessment](#)

This is a list of **intelligence gathering disciplines**.

18.1 HUMINT

Human intelligence—gathered from a person on the ground.

- Espionage
- Friendly accredited diplomats
- Military attachés
- Non-governmental organizations (NGOs)
- Patrolling (Military police, patrols, etc.)
- Prisoners of war (POWs) or detainees
- Refugees
- Strategic reconnaissance, as by special forces
- Traveler debriefing (e.g., CIA Domestic Contact Service)

18.2 GEOINT

Geospatial intelligence—gathered from satellite, aerial photography, mapping/terrain data

- **IMINT**—Imagery intelligence: gathered from satellite and aerial photography

18.3 MASINT

Measurement and signature intelligence:

- Electro-optical MASINT
 - Airborne Electro-Optical Missile Tracking MASINT
 - Tactical Countermortar Sensors

- Infrared MASINT
- Optical Measurement of Nuclear Explosions
- LASER MASINT
- Spectroscopic MASINT
- Hyperspectral Imagery MASINT
- Space-based Staring Infrared Sensors
- Nuclear MASINT
 - Radiation survey and dosimetry
 - Space-based Nuclear Energy Detection
 - Effects of Ionizing Radiation on materials
- Geophysical MASINT
 - Weather and Sea Intelligence MASINT
 - Acoustic MASINT (also known as ACOUSTINT or ACINT - Acoustic phenomena)
 - Seismic MASINT
 - Magnetic MASINT
 - Gravimetric MASINT
- Radar MASINT
 - Line-of-Sight Radar MASINT
 - Synthetic aperture radar (SAR) and Inverse Synthetic Aperture Radar (ISAR) MASINT
 - Non-Cooperative Target Recognition
 - Multistatic Radar MASINT
 - Passive Covert Radar
- Materials MASINT
 - Chemical Materials MASINT
 - Biological Materials MASINT
 - Nuclear test analysis
- Radiofrequency MASINT
 - Frequency Domain MASINT
 - Electromagnetic Pulse MASINT
 - Unintentional Radiation MASINT

18.4 OSINT

Open-source intelligence—gathered from open sources.

Can be further segmented by source type; Internet/General, Scientific/Technical and various HUMINT specialties (e.g. trade shows, association meetings, interviews, etc.)

18.5 SIGINT

Signals intelligence—gathered from interception of signals

- **COMINT**—Communications Intelligence
- **ELINT**—Electronic Intelligence: gathered from electronic signals that do not contain speech or text (which are considered COMINT).
- **FISINT**—Foreign Instrumentation Signals Intelligence, was formerly known as TELINT or Telemetry Intelligence. TELINT, entails the collection and analysis of telemetry data from the target's missile or sometimes from aircraft tests.

18.6 TECHINT

Technical intelligence—gathered from analysis of weapons and equipment used by the armed forces of foreign nations, or environmental conditions.

- **MEDINT**—Medical intelligence: gathered from analysis of medical records and/or actual physiological examinations to determine health and/or particular ailments/allergic conditions for consideration.

18.7 CYBINT/DNINT

Cyber Intelligence/Digital Network Intelligence—gathered from **cyberspace**

18.8 FININT

Financial intelligence—gathered from analysis of monetary transactions

18.9 See also

- Cryptanalysis
- Meteorological intelligence
- Oprint
- Spy satellite
- TEMPEST
- Traffic analysis

18.10 References

Chapter 19

Living creatures (Bible)



Ezekiel's "chariot vision" , by Matthaeus Merian (1593-1650).

The **living creatures**, **living beings**, or **Hayyoth** (Hebrew חַיִּוֹת *chayot*, from חַי *chai*, “live”) are a class of heavenly beings described in **Ezekiel's** vision of the heavenly chariot in the first and tenth chapters of the **Book of Ezekiel**. References to the creatures recur in texts of **Second Temple Judaism**, in rabbinical *merkabah* (“chariot”) literature, and in the **Book of Daniel**, and also in the **Book of Revelation**.

19.1 Ezekiel's four living creatures

Ezekiel's vision of the four living creatures in **Ezekiel** chapter 1 are identified as **cherubim** in chapter 10*[1] who are God's throne bearers.*[2] Cherubim as minor **guardian deities***[3] of temple or palace thresholds are known all

over the **Ancient East**. Each of Ezekiel's cherubim have four faces, that of a man, a lion, an ox, and an eagle.* [2] However, their human shape appearances set them apart from the griffin-like cherubs of **Babylonia** and **Assyria**. In their ability to move, Ezekiel's cherubim do not need to turn, as they front all directional points of the compass.* [1] This description of movement differs from the **seraphim** in Isaiah's vision (**Isaiah 6:2**) who have an extra set of wings for their ability to fly.* [4]

19.2 Daniel's four living creatures

In **Daniel**, four living creatures surround the white throne upon which the **Ancient of Days** sits **Daniel 7:7-13**. This white throne is also referenced in the final judgement in **Revelation 20:11-15**. The four beasts differ from the four beasts in **Ezekiel chapter 1** and **Revelation 4:6-8** in that there are a lion, a calf, an eagle and a man faced creature. The beasts have four wings, just as the beasts in Ezekiel have four wings, as contrasted with the beasts in Revelation which each have six wings. The first beast has its wings removed, it is stood upright, and it is given the mind of a man. The second beast, which resembles a bear, has three ribs in its mouth and is told to 'Get up and eat your fill of flesh!' The third beast, which resembles a leopard, is described as having four heads, like the beasts in Ezekiel and Revelation. This beast which is given authority to rule, closely matches the description of the Dragon, the "beast out of the sea" in **Revelation chapter 13**, which is also given authority. The final beast, is a mechanical beast with large iron teeth. It crushes and devours its victims, and tramples underfoot whatever is left. This beast most resembles the winepress spoken of in **Revelation 14:18-20**.

19.3 Revelation's four living beings

In **Revelation 4:6-8**, four living beings (Greek: τέσσαρα ζῷα, *tessera zō[i]a*) are seen in John's vision. These appear as a lion, an ox, a man, and an eagle, much as in Ezekiel but in a different order. They have six wings, whereas Ezekiel's four living creatures are described as only having four. In verse 6, they are said to have "eyes all over, front and back" which suggests that they are alert and knowledgeable, that nothing escapes their notice. The description parallels the *wheels* that are beside the living creatures in **Ezekiel 1:18; 10:12**, that are said to be "full of eyes all around". The Hebrew word for "wheel" (*ōpannîm*) was also used in later Jewish literature to indicate a member of the angelic orders (**1 Enoch 71.7; 3 Enoch 1.8; 7.1; 25.5-6**, etc.). The term "eyes" can also be used as a metaphor for "stars". In Revelation, these four beasts surround "the one" on the red throne (which is of ruby and sardius), which is contrasted with the white throne in **Daniel Daniel 7:9** and **Revelation Revelation 20:11-15**.

Comparing the living creatures in Ezekiel with Revelation's is a prominent apocalyptic study in Western Christianity.* [5] An example is the 18th Century works of **Jonathan Edwards'** recorded interpretation of 1722/23.* [6] The four living creatures that **John of Patmos** sees in the **Book of Revelation**, is the author's reworking of the living creatures in the visions of Ezekiel (**Ezekiel 1:5-28**)* [7] and Isaiah (**Isaiah 6:2**).* [8] **William D. Mounce** noted a belief that the living creatures may have been associated with the four principal signs of the zodiac.* [7]

In a critical analysis of John's vision, **April De Conick's** 2006 essay outlines that the *hayyot* in Ezekiel are perhaps not original with the author of Revelation. De Conick suggests that John may have drawn from other **merkabah**-related texts and by subtly working with images already known to his audience, he reshaped them for his own purposes.* [9] With John blending and transforming the images of his sources, it has given way to different interpretations.* [7]

19.4 Religious views

In Judaism, the living beings are considered angels of fire, who hold up the throne of God and the earth itself.* [10] They are ranked first in **Maimonides'** Jewish angelic hierarchy.

In Christianity, the four living creatures are **Cherubim**.* [3] A prominent early interpretation, variously modified by different interpreters, has been to equate the four creatures as a **tetramorph** of the **Four Evangelists**. Throughout church history, the most common interpretation (first laid out by **Victorinus**), but not the original or the only, is that the lion represents **Mark**, the calf **Luke**, the man **Matthew**, and the eagle **John**. **Irenaeus** was the first to make the association with the evangelists, but the interpretation laid out by **Victorinus** and adopted by **Jerome**, **Gregory the Great**, and the **Book of Kells** became dominant.* [11] Its influence has been on art and sculpture* [8] and is still prevalent in **Catholicism*** [12] and **Anglicanism**.* [13]

19.5 See also

- Seraph
- Angel
- Related Bible parts: Isaiah 6, Ezekiel 1, Ezekiel 10, Daniel 7, Revelation 4, Revelation 20

19.6 References

- [1] Eichrodt 2003, p. 55
 - [2] Duguid, Iain M. (2011). *Ezekiel: The NIV Application Commentary*. Zondervan. ISBN 9780310866107.
 - [3] Donald Senior, John J. Collins (2011). *Catholic Study Bible-NABRE*; See footnote 1:5 “Four living creatures” . Oxford University Press. p. 1162. ISBN 9780195297751.
 - [4] Eichrodt 2003, p. 57
 - [5] Pate, C. Marvin (2009). *Reading Revelation: A Comparison of Four Interpretive Translations of the Apocalypse*. Kregel Academic. ISBN 9780825433672.
 - [6] Kreider, Glenn (2004). *Jonathan Edwards' Interpretation of Revelation 4:1-8:1*. University Press of America. p. 111. ISBN 9780761826705.
 - [7] Smalley, Stephen S. (2012). *The Revelation to John: A Commentary on the Greek Text of the Apocalypse*. InterVarsity Press. pp. 120–121. ISBN 9780830829248.
 - [8] Woodman, Simon P (2008). *The Book of Revelation*. Hymns Ancient and Modern Ltd. p. 128. ISBN 9780334041047.
 - [9] De Conick, April D (2006). *Paradise Now: Essays on Early Jewish and Christian Mysticism*. Society of Biblical Literature. pp. 203–204. ISBN 9781589832572.
 - [10] Davidson, Gustav (1967). *A Dictionary of Angels, Including The Fallen Angels*. Library of Congress Catalog Card Number: 66-19757: Free Press. p. 120. ISBN 9780029070505.
 - [11] Judith Kovacs, Christopher Rowland (2004). *Revelation: The Apocalypse of Jesus Christ*. Oxford: Blackwell publishing. p. 66. ISBN 9781405143219.
 - [12] Barber, Michael (2005). *Coming Soon: Unlocking the Book of Revelation and Applying Its Lessons Today*. Emmaus Road Publishing. p. 86. ISBN 9781931018265.
 - [13] Stevenson, Kenneth (2001). *Biblica, Vol.34: Animal Rites: The Four Living Creatures in Patristic Exegesis and Liturgy*. Peeters Publishers. p. 470. ISBN 9789042908819.
- Eichrodt, Walther (2003). *Ezekiel: A Commentary*. Westminster John Knox Press. ISBN 9780664227661.

19.7 External links

- Jewish Encyclopedia: Angelology

Chapter 20

Lost, mislaid, and abandoned property

Lost, mislaid, and abandoned property are categories of the **common law** of **property** which deals with **personal property** or chattel which has left the possession of its rightful owner without having directly entered the possession of another person. Property can be considered lost, mislaid or abandoned depending on the circumstances under which it is found by the next party who obtains its possession.

There is an old saying that *possession is nine-tenths of the law*, perhaps dating back centuries. This means that in most cases, the possessor of a piece of property is its rightful owner without evidence to the contrary. More colloquially, this may be called **finders, keepers**. The contradiction to this principle is **theft by finding**, which may occur if **conversion** occurs after finding someone else's property.

The rights of a finder of such property are determined in part by the status in which it is found. Because these classifications have developed under the common law of **England**, they turn on nuanced distinctions. The general rule attaching to the three types of property may be summarized as: *A finder of property acquires no rights in mislaid property, is entitled to possession of lost property against everyone except the true owner, and is entitled to keep abandoned property.**[1] This rule varies by jurisdiction.*[2]

20.1 Lost property

Property is generally deemed to have been **lost** if it is found in a place where the true owner likely did not intend to set it down, and where it is not likely to be found by the true owner. At common law, the finder of a lost item could claim the right to possess the item against any person except the true owner or any previous possessors.*[3]*[2]

The underlying policy goals to these distinctions are to (hopefully) see that the property is returned to its true original owner, or “title owner.” Most jurisdictions have now enacted **statutes** requiring that the finder of lost property turn it in to the proper authorities; if the true owner does not arrive to claim the property within a certain period of time, the property is returned to the finder as his own, or is disposed of.*[4] In **Britain**, many public businesses have a dedicated Lost Property Office (LPO), which in the **United States** would be called a **lost and found**.

Many exceptions may be applied at common law to the rule that the first finder of lost property has a superior claim of right over any other person except the previous owner. For example, a **trespasser's** claim to lost property which he finds while trespassing is generally inferior to the claim of the respective landowner. As a corollary to this exception, a landowner has superior claim over a find made within the non-public areas of his property, so if a customer finds lost property in the public area of a store, the customer has superior claim to the lost property over that of the store-owner, but if the customer finds the lost property in the non-public area of that store, such as an area marked “Employees Only,” the store-owner will have superior claim, as the customer was trespassing when he found it.*[5]

The status of finders as employees or **tenants** of the landowner complicates matters, because employees and tenants have legitimate access to non-public areas of a landowner's property that others would not, without trespassing. Employees and tenants, however, still usually lose superior claim over lost property to their employers or landlords if the property is found within the scope of their employment, or outside the actual leased area, respectively.*[6]

For example, if the lost property is found by a tenant inside the walls of his leasehold, or by an employee embedded within the soil of an estate owned by his employer, the landowner (as employer or landlord) of the property where it was found usually has a superior claim of right over that of the finder. However, this is not always the case, as a

long-term tenant who finds lost property within the leased area of his leasehold may have a superior claim over that of his landlord (especially if the landlord has never been to the property). While employers usually have a superior claim over lost property found by their employees, exceptions to this exist as well, as modern law sometimes grants the employee superior claim if turning over lost property to his employer is not part of his job description (such as if the employee is an interior decorator).*[7]

20.1.1 Animals

Since **animals** are mobile and are thus capable of becoming lost on their own, the loss of property that is a valuable animal has its own set of rules. A valuable animal that becomes lost usually does so by leaving its owner's real property and arriving on another property owner's land; such an animal is legally termed an **estrays**. Estrays are normally confined to **domesticated animals**, like **livestock**, and not wild animals. Since common pets are not considered valuable animals, **dogs** and **cats** are never considered estrays.

In many jurisdictions of the U.S., a person who discovers an estray will be required to file an affidavit of estray, along with its description, and potentially impound that animal in some way for a period of time. If the estray is **branded**, the owner can often be identified immediately. The owner of the estray will generally have a limited time frame in which to reclaim his property after a Notice of Estray is published, but on the expiration of such time another person or entity will be designated the new title owner of the property. Fees for impounding the estray will often accumulate which the property owner will be responsible for paying.

The status of a stray **domestic animal** is highly dependent on local jurisdictions. See **Feral cat**, **Free-ranging dog**. Given the significant number of feral dogs and cats, the finder of a lost dog or cat may have little or no restrictions to claiming the animal as his own property.*[8]

20.1.2 Slaves

Like animals, **fugitive slaves in the United States** (runaway slaves) were a type of property that was capable of relocating to other places. Slave owners depended on others to identify and return their property; some slaves would be **branded** if a slave was known to run away. Numerous laws in the U.S., like the **Fugitive Slave Clause of the Constitution of 1789**, the **Fugitive Slave Act of 1793**, and the **Fugitive Slave Act of 1850** all stipulated that the slaves be captured and returned to their owner. These laws, now superseded by **Thirteenth Amendment to the Constitution of 1865**, were demanded by the **Southern States of the U.S.** but were actively opposed in most Northern states. Activists against slavery and the fugitive slave laws, such as members of the **Underground Railroad**, routinely violated the laws and refused to return slaves to their owners.

Of the 5 laws agreed upon in the **Compromise of 1850**, the fugitive slave laws were by far the most contentious, although many of the issues were split along **regional lines** with Northerners and Southerners diametrically opposed. In **Harriet Beecher Stowe's 1852 novel *Uncle Tom's Cabin***, the issue of runaway slaves was a central theme. These property and fugitive slave issues, along with **other events related to slavery**, would propel the U.S. into civil war.

20.1.3 Unclaimed property

Unclaimed Property laws in the United States provide for two reporting periods each year whereby unclaimed bank accounts, stocks, insurance proceeds, utility deposits, un-cashed checks and other forms of "personal property" are reported first to the individual state's Unclaimed Property Office, then published in a local newspaper and then finally the property is turned over to the State for safe keeping until its rightful owner makes a claim. The states sponsor a free public site that reports only a portion of the unclaimed property available in the United States. There are commercial sites as well that provide the same information or portions of the information for a fee. Some consumer reporting sites that conduct the research and assist consumers will do so without charge or expense to the consumers.

20.2 Mislaid property

Property is generally deemed to have been **mislaid** or **misplaced** if it is found in a place where the true owner likely *did* intend to set it, but then simply forgot to pick it up again. For example, a wallet found in a shop lying on a counter near a cash register will likely be deemed *misplaced* rather than *lost*. Under common law principles, the finder of a

misplaced object has a duty to turn it over to the owner of the premises, on the theory that the true owner is likely to return to that location to search for his misplaced item. If the true owner does not return within a reasonable time (which varies considerably depending on the circumstances), the property becomes that of the owner of the premises.* [9]

20.3 Abandoned property



Maui Police Department sticker affixed to abandoned cars.

Main article: [Abandonment \(legal\)](#)

Property is generally deemed to have been abandoned if it is found in a place where the true owner likely intended to leave it, but is in such a condition that it is apparent that he or she has no intention of returning to claim it. Abandoned property generally becomes the property of whoever should find it and take possession of it first, although some states have enacted statutes under which certain kinds of abandoned property – usually cars, wrecked ships and wrecked aircraft – *escheat*, meaning that they become the property of the state.* [10]

20.3.1 Treasure trove

Main article: [Treasure trove](#)

Treasure trove is property that consists of coins or currency hidden by the owner. To be considered *treasure trove* and not *mislaidd property*, the property must have been deliberately hidden or concealed, and sufficiently long ago that the original owner can be considered dead or not discoverable. For example, under English law, one hundred Roman coins found buried in a chest would be treasure trove; however, one hundred Roman coins which were lost over time in a marketplace would not be treasure trove, as they were not deliberately hidden as a single hoard.

Under American common law, treasure trove belongs to the finder unless the original owner reclaims. Some states have rejected the American common law and hold that treasure trove belongs to the owner of the property in which the treasure trove was found. These courts reason that the American common law rule encourages trespass.

Under the traditional English common law, treasure trove belongs to the Crown, though the finder may be paid a reward.

20.4 Recent developments

In the United States, the National Conference of Commissioners on Uniform State Laws sought to address the problems arising from these types of property through provisions of the Uniform Unclaimed Property Act. The act was first drafted and promulgated in 1981 and a revised version, the Revised Uniform Unclaimed Property Act was introduced in 1995. The act specifically focuses on the problem of unclaimed money in bank accounts and corporate coffers, and the corresponding escheatment.

As a result of the Act, each state that has adopted the act, operates an Unclaimed Property fund in which the proceeds from abandoned bank accounts, unpresented checks, etc. are to be turned over to the state after a specified period of time. Depending on state law, the money may be held either in perpetuity (i.e., the funds *never* escheat to the state; an example would be Texas^[11]), or after a long period of time (whereby it is presumed that the owner is deceased with no heirs) the funds will escheat to the state. Due to the increasing mobility of the population, 39 states have joined together to operate MissingMoney.com,^[12] a searchable database which lists unclaimed funds in these states. Another website at Unclaimed.org allows searches without charge for the remaining 11 states.^[12] Many commercial websites also offer this service at a charge. A searchable database for unclaimed money and property is available in Canada from the Bank of Canada.

A similar problem has developed with respect to orphan works, artistic or literary works for which a copyright is in effect, but for whom the copyright owner cannot be found.^[13]

20.5 See also

- Squatting
- Marine salvage
- Adverse possession
- Escheat – forfeit of property to the state
- Bona vacantia – precedent of escheat
- Probate – settling an estate after death
- Trover
- Old field (ecology)

20.6 References

- [1] *Michael v. First Chicago Corp.*, 139 Ill. App. 3d 374, 382, 487 N.E.2d 403, 409 (1985)
- [2] Jesse Dukeminier and James E. Krier, *Property, Fifth Edition*, Aspen Law & Business (New York, 2002), p. 120. ISBN 0-7355-2437-8
- [3] *Armory v. Delamirie*, 1 Strange 505 (King's Bench, 1722)
- [4] Jesse Dukeminier and James E. Krier, *Property, Fifth Edition*, Aspen Law & Business (New York, 2002), p. 123-24. ISBN 0-7355-2437-8
- [5] *Bridges v. Hawkesworth*, (1851)

- [6] Jesse Dukeminier and James E. Krier, *Property, Fifth Edition*, Aspen Law & Business (New York, 2002), p. 120-123. ISBN 0-7355-2437-8
- [7] *Erickson v. Sinykin*, 26 N.W.2d 172 (Minn. 1947)
- [8] “Lost Dogs” . animallaw.info.
- [9] *McAvoy v. Medina*, 93 Mass. (11 Allen) 548, (1866)
- [10] *Eads v. Brazelton*, 22 Ark. 499 (Ark. 1861)
- [11] Texas Comptroller of Public Accounts general information on unclaimed money.
- [12] Leamy, Elisabeth; Leamy, Elisabeth (22 December 2016). “How to find and claim cash you didn’ t know you had” – via washingtonpost.com.
- [13] Jon W. Bruce and James W. Ely Jr., *Cases and Materials on Modern Property Law*, West Group (St. Paul MN, 2003) p. 152. ISBN 0-314-26032-3

20.7 External links

- Unclaimed Property Professionals Organization

Chapter 21

Lovers rock

For other uses, see [Lovers Rock \(disambiguation\)](#).

Lovers rock is a style of [reggae](#) music noted for its [romantic](#) sound and content. While love songs had been an important part of reggae since the late 1960s, the style was given a greater focus and a name in [London](#) in the mid-1970s. ^[1] Despite the name, lovers rock is not a rock subgenre or related to it.

21.1 History

The roots of lovers rock lies in the last days of the [rocksteady](#) era and early days of [reggae](#), with Jamaican and American singers such as [Ken Boothe](#), [Johnny Nash](#) and [John Holt](#) enjoying international hits with versions of well-known love songs. ^[2]

A style suited to the [London](#) reggae scene, lovers rock represented an apolitical counterpoint to the conscious [Rastafarian](#) sound dominant in [Jamaica](#) at the time, a continuation of the soulful and commonly love-themed rocksteady style, based on singers like [Alton Ellis](#), who were not very optimistic about the rise of rastafarian reggae. ^[1] It combined the smooth soul sounds of [Chicago](#) and [Philadelphia soul](#) with rocksteady and reggae bassline rhythms. ^[3] ^[4] Rooted in the [sound systems](#) of [South London](#), the style had particular appeal amongst women and produced many female stars including [Carroll Thompson](#). [Louisa Mark](#) was aged 14 when she had a major lovers rock hit with her version of [Bobby Parker's](#) “Caught You in a Lie” in 1975. This spawned the distinctive young girl female sound associated with early lovers rock. Simplicity formed in 1975 and released their first hit “To Be in Love” produced by Coxson; the B-side was the [Emotions](#) classic, “A Feeling is a Feeling”. They were headhunted by Neville King who produced their hits “Loving Kind”, “Waiting” and “Black is our Colour”. This was followed by the husband and wife production team of Dennis and Eve Harris who then had a big hit with [T.T. Ross's](#) “Last Date”. Dennis Harris then set up a new record label, Lover's Rock, at the south east London premises on Upper Brockley Road along with [John Kpiaye](#) and [Dennis Bovell](#), which gave the new genre a name. ^[4]

South London trio [Brown Sugar](#) (including a young [Caron Wheeler](#), later of [Soul II Soul](#)) pioneered a subgenre, 'conscious lovers', with songs such as “I'm In Love With a Dreadlocks” and “Black Pride”. Others who released records in this subgenre included the [Battersea](#) songstress [Winsome](#) and [Kofi](#). ^[4] Lovers rock became a staple of London's [sound systems](#) such as [Chicken Hi-Fi](#), [Success Sound](#), and [Soferno B](#). ^[2] [Neil “Mad Professor” Fraser](#) would be a key lovers rock producer, working with [Deborah Glasgow](#), while [Bovell](#) would produce one of the genre's biggest hits, [Janet Kay's](#) “Silly Games”, which reached number 2 in the [UK Singles Chart](#) in 1979. ^[1] ^[2] ^[3] Although noted for the preponderance and youth of its female exponents, the new style produced male stars as well, notably [Trevor Walters](#), [Honey Boy](#), and [Winston Reedy](#). The trend also saw the emergence of many male groups, including [Tradition](#), [The Investigators](#) and the [Birmingham](#) group [Beshara](#), who in 1981, had the emotive reggae chart hit “Men Cry Too”.

Subsequently, numerous well-established Jamaican acts came to try their hand at the new sound. Most successful among these were [Gregory Isaacs](#), [Dennis Brown](#), [Sugar Minott](#), and later [Freddie McGregor](#). ^[2] ^[3] Brown's “Money In My Pocket” (#14 in 1979) and Minott's “Good Thing Going” (#4 in 1981) were both big hits in the [UK Singles Chart](#). ^[2]

Seminal [punk/rock/ska/reggae crossover](#) band [The Clash](#) popularised the term, introducing it to a wider mainstream

audience, by including a song called “Lover's Rock” on their 1979 signature double LP, *London Calling*.

The popularity of lovers rock has continued, and in the 1980s the *Fashion* label was successful with UK audiences, and the *Revue* label had a major hit in 1986 with *Boris Gardiner's* “I Wanna Wake Up With You” .*[2] In the 1990s, the likes of *Mike Anthony*, *Peter Hunnigale* and *Donna Marie* enjoyed success with the genre, and several British stars have performed at *Reggae Sunsplash*.*[2]*[4] The 21st century has seen lovers rock being exposed to more audiences by impresario *Orlando Gittens*, who has pioneered the “Giants of Lovers Rock” series of concerts at London's *O2 arena*.

21.2 See also

- [List of lovers rock artists](#)

21.3 References

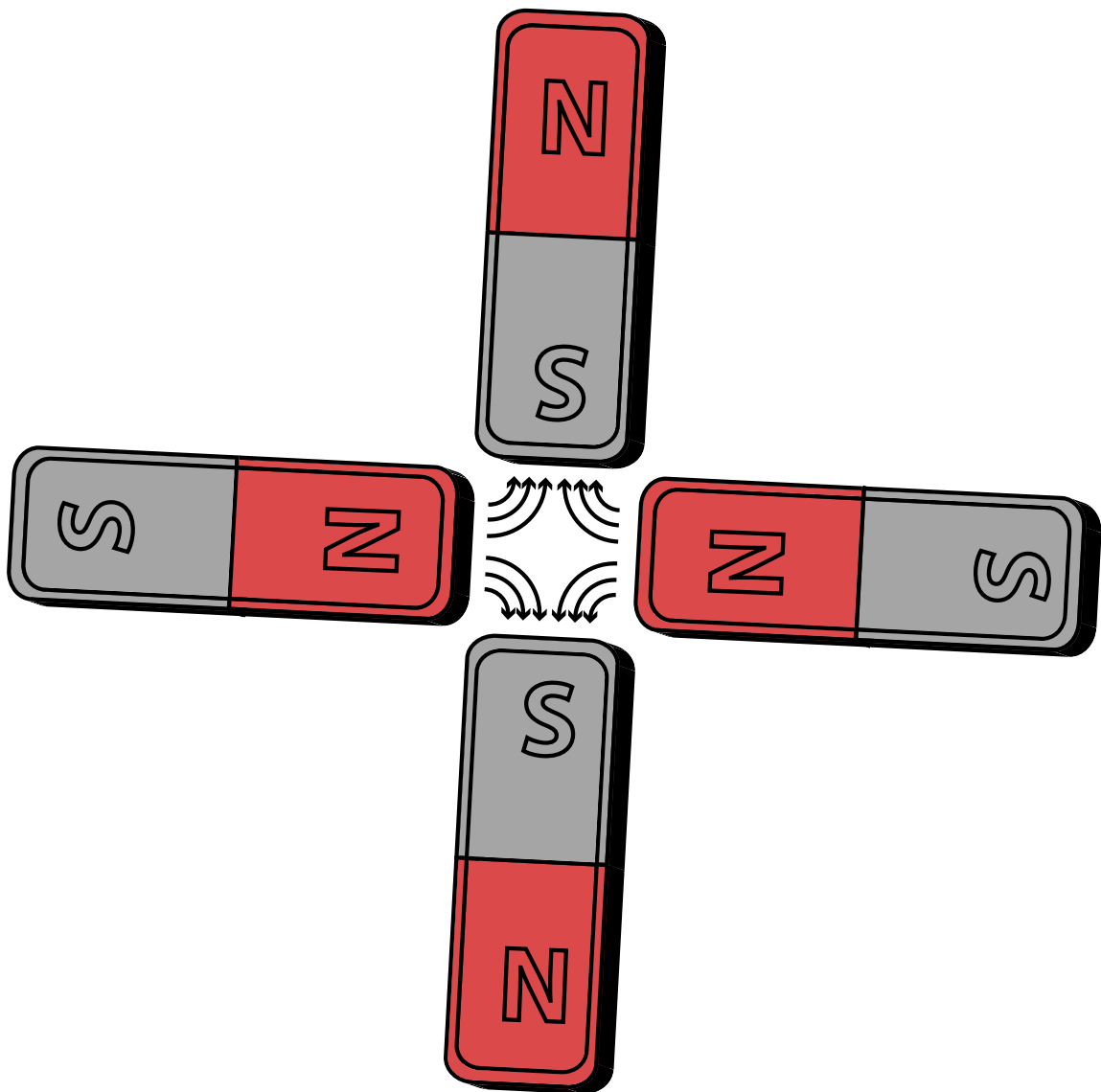
- [1] *Larkin, Colin* (1998) “The Virgin Encyclopedia of Reggae” , Virgin Books, ISBN 0-7535-0242-9
- [2] *Thompson, Dave* (2002) “Reggae & Caribbean Music” , Backbeat Books, ISBN 0-87930-655-6
- [3] “*Lovers Rock*” , [allmusic.com](#), Macrovision Corporation
- [4] *Barrow, Steve & Dalton, Peter* (2004) “The Rough Guide to Reggae” , Rough Guides, ISBN 1-84353-329-4

Chapter 22

Magnetism

“Magnetic” redirects here. For other uses, see [Magnetic \(disambiguation\)](#) and [Magnetism \(disambiguation\)](#).

Magnetism is a class of physical phenomena that are mediated by magnetic fields. Electric currents and the magnetic



A magnetic quadrupole

moments of elementary particles give rise to a magnetic field, which acts on other currents and magnetic moments.

The most familiar effects occur in **ferromagnetic** materials, which are strongly attracted by magnetic fields and can be **magnetized** to become permanent **magnets**, producing magnetic fields themselves. Only a few substances are ferromagnetic; the most common ones are **iron**, **nickel** and **cobalt** and their alloys. The prefix *ferro-* refers to **iron**, because permanent magnetism was first observed in **lodestone**, a form of natural iron ore called **magnetite**, Fe_3O_4 .

Although ferromagnetism is responsible for most of the effects of magnetism encountered in everyday life, all other materials are influenced to some extent by a magnetic field, by several other types of magnetism. **Paramagnetic** substances such as **aluminum** and **oxygen** are weakly attracted to an applied magnetic field; **diamagnetic** substances such as **copper** and **carbon** are weakly repelled; while **antiferromagnetic** materials such as **chromium** and **spin glasses** have a more complex relationship with a magnetic field. The force of a magnet on paramagnetic, diamagnetic, antiferromagnetic materials is usually too weak to be felt, and can be detected only by laboratory instruments, so in everyday life these substances are often described as non-magnetic.

The magnetic state (or magnetic phase) of a material depends on temperature and other variables such as pressure and the applied magnetic field. A material may exhibit more than one form of magnetism as these variables change.

22.1 History

Main article: **History of electromagnetism**

Magnetism was first discovered in the ancient world, when people noticed that **lodestones**, naturally magnetized pieces of the mineral **magnetite**, could attract iron.* [1] The word *magnet* comes from the Greek term for lodestone, “*magnítis líthos*” (μαγνήτης λίθος), which means a stone from the region of **Magnesia**. In ancient Greece, Aristotle attributed the first of what could be called a scientific discussion of magnetism to the philosopher **Thales of Miletus**, who lived from about 625 BC to about 545 BC.* [2] Around the same time, in ancient India, the Indian surgeon **Sushruta** was the first to make use of the magnet for surgical purposes.* [3]

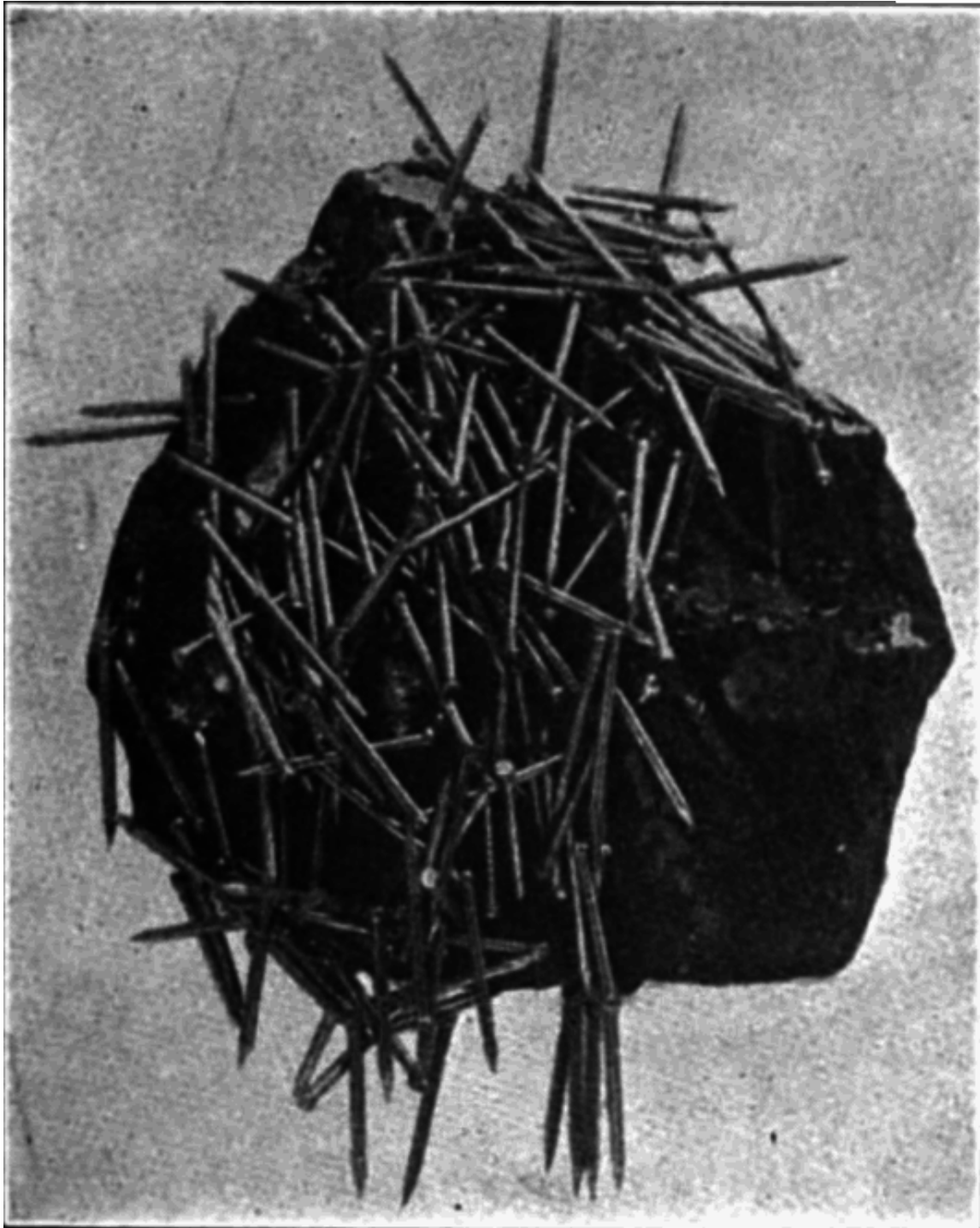
In ancient China, the earliest literary reference to magnetism lies in a 4th-century BC book named after its author, *The Master of Demon Valley*.* [4] The 2nd-century BC annals, *Liushi Chunqiu*, also notes: “The lodestone makes iron approach, or it attracts it.”* [5] The earliest mention of the attraction of a needle is in a 1st-century work *Lunheng* (*Balanced Inquiries*): “A lodestone attracts a needle.”* [6] The 11th-century Chinese scientist **Shen Kuo** was the first person to write – in the *Dream Pool Essays* – of the magnetic needle compass and that it improved the accuracy of navigation by employing the astronomical concept of true north. By the 12th century the Chinese were known to use the lodestone compass for navigation. They sculpted a directional spoon from lodestone in such a way that the handle of the spoon always pointed south.

Alexander Neckam, by 1187, was the first in Europe to describe the compass and its use for navigation. In 1269, **Peter Peregrinus de Maricourt** wrote the *Epistola de magnete*, the first extant treatise describing the properties of magnets. In 1282, the properties of magnets and the dry compass were discussed by **Al-Ashraf**, a **Yemeni** physicist, astronomer, and geographer.* [7]

In 1600, **William Gilbert** published his *De Magnete, Magneticisque Corporibus, et de Magno Magnete Tellure* (*On the Magnet and Magnetic Bodies, and on the Great Magnet the Earth*). In this work he describes many of his experiments with his model earth called the **terrella**. From his experiments, he concluded that the **Earth** was itself magnetic and that this was the reason compasses pointed north (previously, some believed that it was the pole star (**Polaris**) or a large magnetic island on the north pole that attracted the compass).

An understanding of the relationship between **electricity** and magnetism began in 1819 with work by **Hans Christian Ørsted**, a professor at the University of Copenhagen, who discovered by the accidental twitching of a compass needle near a wire that an electric current could create a magnetic field. This landmark experiment is known as Ørsted's Experiment. Several other experiments followed, with **André-Marie Ampère**, who in 1820 discovered that the magnetic field circulating in a closed-path was related to the current flowing through the perimeter of the path; **Carl Friedrich Gauss**; **Jean-Baptiste Biot** and **Félix Savart**, both of whom in 1820 came up with the **Biot–Savart law** giving an equation for the magnetic field from a current-carrying wire; **Michael Faraday**, who in 1831 found that a time-varying magnetic flux through a loop of wire induced a voltage, and others finding further links between magnetism and electricity. **James Clerk Maxwell** synthesized and expanded these insights into **Maxwell's equations**, unifying electricity, magnetism, and optics into the field of **electromagnetism**. In 1905, **Einstein** used these laws in motivating his theory of **special relativity**,* [8] requiring that the laws held true in all **inertial reference frames**.

Electromagnetism has continued to develop into the 21st century, being incorporated into the more fundamental theories of **gauge theory**, **quantum electrodynamics**, **electroweak theory**, and finally the **standard model**.



Lodestone, a natural magnet, attracting iron nails. Ancient humans discovered the property of magnetism from lodestone.

22.2 Sources of magnetism

See also: [Magnetic moment](#)

Magnetism, at its root, arises from two sources:

1. Electric current (see *Electron magnetic moment*).
2. Spin magnetic moments of elementary particles. The magnetic moments of the nuclei of atoms are typically



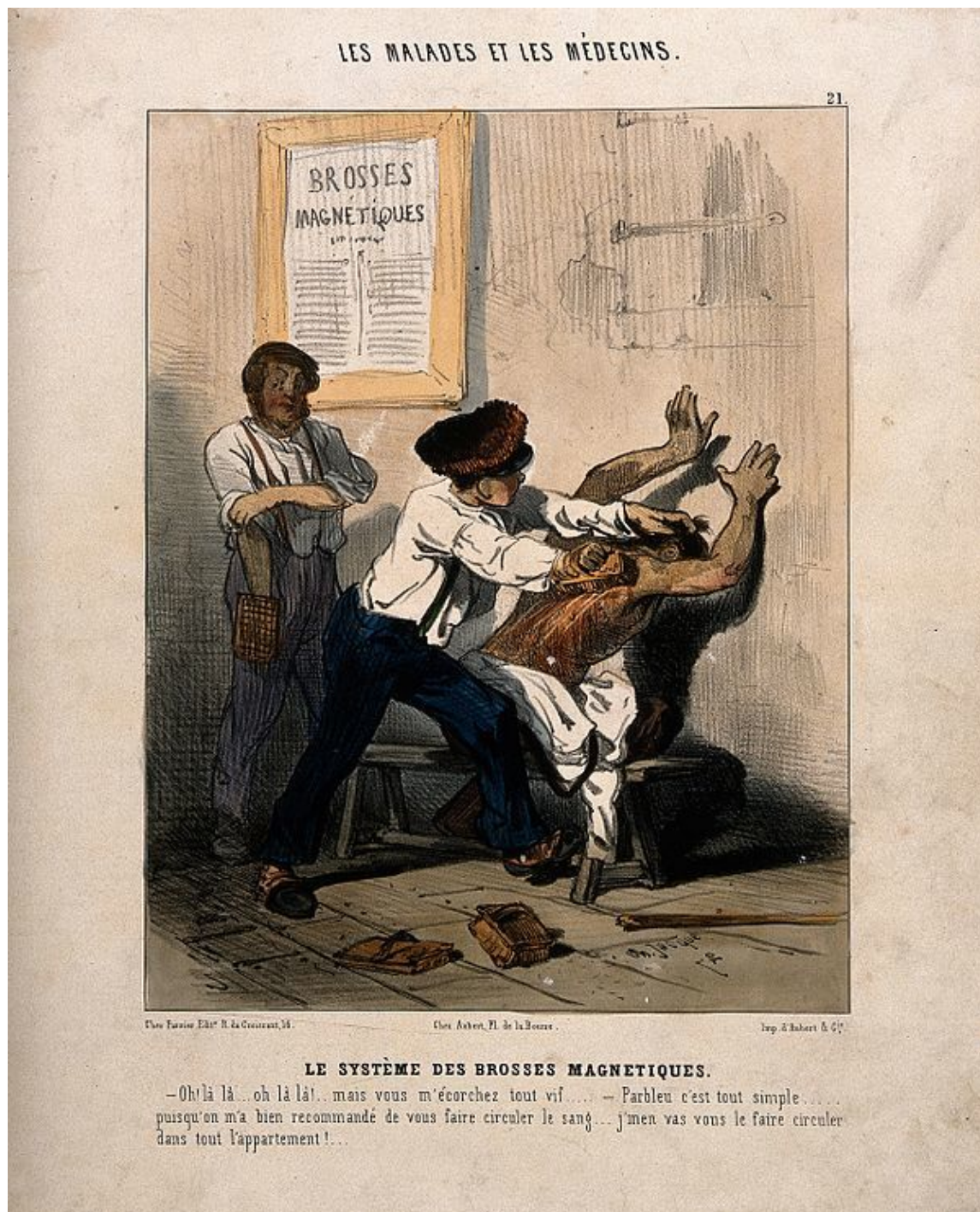
An illustration from Gilbert's 1600 *De Magnete* showing one of the earliest methods of making a magnet. A blacksmith holds a piece of red-hot iron in a north-south direction and hammers it as it cools. The magnetic field of the Earth aligns the domains, leaving the iron a weak magnet.

thousands of times smaller than the electrons' magnetic moments, so they are negligible in the context of the magnetization of materials. Nuclear magnetic moments are nevertheless very important in other contexts, particularly in **nuclear magnetic resonance (NMR)** and **magnetic resonance imaging (MRI)**.

Ordinarily, the enormous number of electrons in a material are arranged such that their magnetic moments (both orbital and intrinsic) cancel out. This is due, to some extent, to electrons combining into pairs with opposite intrinsic magnetic moments as a result of the **Pauli exclusion principle** (see *electron configuration*), or combining into filled **subshells** with zero net orbital motion. In both cases, the electron arrangement is so as to exactly cancel the magnetic moments from each electron. Moreover, even when the *electron configuration* is such that there are unpaired electrons and/or non-filled subshells, it is often the case that the various electrons in the solid will contribute magnetic moments that point in different, random directions, so that the material will not be magnetic.

Sometimes, either spontaneously, or owing to an applied external magnetic field—each of the electron magnetic moments will be, on average, lined up. A suitable material can then produce a strong net magnetic field.

The magnetic behavior of a material depends on its structure, particularly its **electron configuration**, for the reasons mentioned above, and also on the temperature. At high temperatures, random **thermal motion** makes it more difficult for the electrons to maintain alignment.



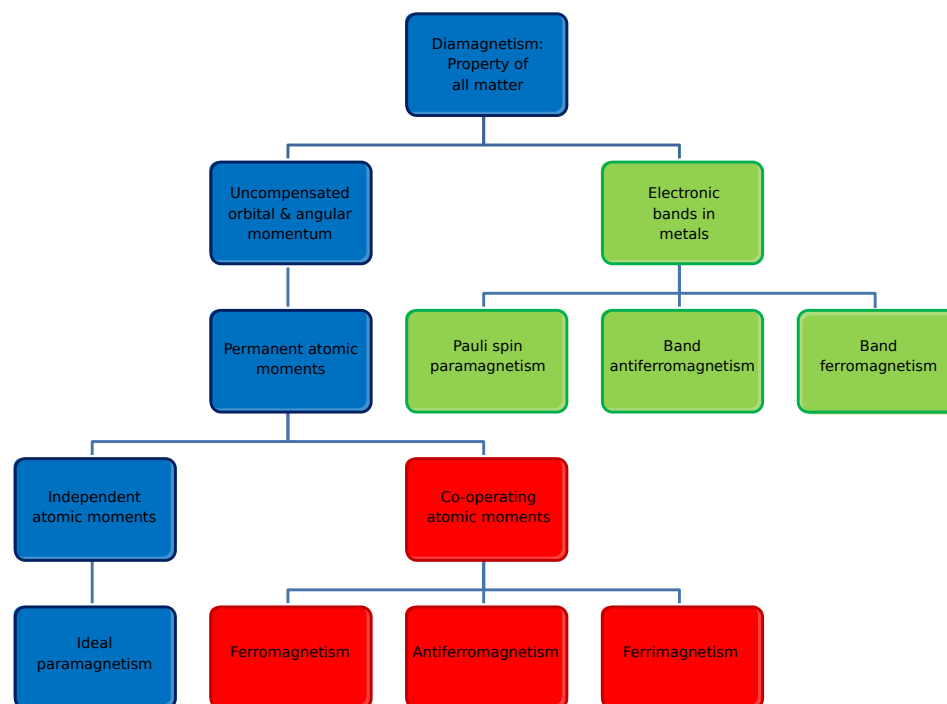
Drawing of a medical treatment using magnetic brushes. Charles Jacque 1843, France.

22.3 Materials

22.3.1 Diamagnetism

Main article: [Diamagnetism](#)

Diamagnetism appears in all materials, and is the tendency of a material to oppose an applied magnetic field, and therefore, to be repelled by a magnetic field. However, in a material with paramagnetic properties (that is, with a tendency to enhance an external magnetic field), the paramagnetic behavior dominates.*^[10] Thus, despite its universal



*Hierarchy of types of magnetism. * [9]*

occurrence, diamagnetic behavior is observed only in a purely diamagnetic material. In a diamagnetic material, there are no unpaired electrons, so the intrinsic electron magnetic moments cannot produce any bulk effect. In these cases, the magnetization arises from the electrons' orbital motions, which can be understood classically as follows:

When a material is put in a magnetic field, the electrons circling the nucleus will experience, in addition to their Coulomb attraction to the nucleus, a Lorentz force from the magnetic field. Depending on which direction the electron is orbiting, this force may increase the centripetal force on the electrons, pulling them in towards the nucleus, or it may decrease the force, pulling them away from the nucleus. This effect systematically increases the orbital magnetic moments that were aligned opposite the field, and decreases the ones aligned parallel to the field (in accordance with Lenz's law). This results in a small bulk magnetic moment, with an opposite direction to the applied field.

Note that this description is meant only as a heuristic; a proper understanding requires a quantum-mechanical description.

Note that all materials undergo this orbital response. However, in paramagnetic and ferromagnetic substances, the diamagnetic effect is overwhelmed by the much stronger effects caused by the unpaired electrons.

22.3.2 Paramagnetism

Main article: [Paramagnetism](#)

In a paramagnetic material there are *unpaired electrons*, i.e. atomic or molecular orbitals with exactly one electron in them. While paired electrons are required by the Pauli exclusion principle to have their intrinsic ('spin') magnetic moments pointing in opposite directions, causing their magnetic fields to cancel out, an unpaired electron is free to align its magnetic moment in any direction. When an external magnetic field is applied, these magnetic moments will tend to align themselves in the same direction as the applied field, thus reinforcing it.



Tip of permanent magnet with coins demonstrating ferromagnetism

22.3.3 Ferromagnetism

Main article: [Ferromagnetism](#)

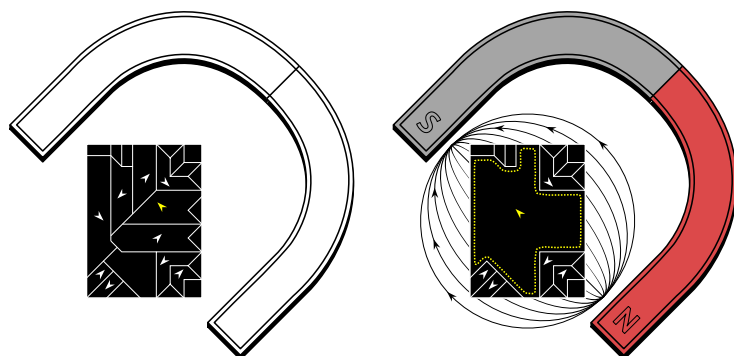
A ferromagnet, like a paramagnetic substance, has unpaired electrons. However, in *addition* to the electrons' intrinsic magnetic moment's tendency to be parallel to an *applied field*, there is also in these materials a tendency for these magnetic moments to orient parallel to *each other* to maintain a lowered-energy state. Thus, even in the absence of an applied field, the magnetic moments of the electrons in the material spontaneously line up parallel to one another.

Every ferromagnetic substance has its own individual temperature, called the **Curie temperature**, or Curie point, above which it loses its ferromagnetic properties. This is because the thermal tendency to disorder overwhelms the energy-lowering due to ferromagnetic order.

Ferromagnetism only occurs in a few substances; the common ones are iron, nickel, cobalt, their alloys, and some alloys of **rare earth** metals.

Magnetic domains

Main article: [Magnetic domains](#)



Left: Magnetic domains boundaries (white lines) in ferromagnetic material (black rectangle). **Right:** Effect of a magnet on the domains.

The magnetic moments of atoms in a **ferromagnetic** material cause them to behave something like tiny permanent magnets. They stick together and align themselves into small regions of more or less uniform alignment called **magnetic domains** or **Weiss domains**. Magnetic domains can be observed with a **magnetic force microscope** to reveal magnetic domain boundaries that resemble white lines in the sketch. There are many scientific experiments that can physically show magnetic fields.

When a domain contains too many molecules, it becomes unstable and divides into two domains aligned in opposite directions so that they stick together more stably as shown at the right.

When exposed to a magnetic field, the domain boundaries move so that the domains aligned with the magnetic field grow and dominate the structure (dotted yellow area) as shown at the left. When the magnetizing field is removed, the domains may not return to an unmagnetized state. This results in the ferromagnetic material's being magnetized, forming a permanent magnet.

When magnetized strongly enough that the prevailing domain overruns all others to result in only one single domain, the material is **magnetically saturated**. When a magnetized ferromagnetic material is heated to the **Curie point** temperature, the molecules are agitated to the point that the magnetic domains lose the organization and the magnetic properties they cause cease. When the material is cooled, this domain alignment structure spontaneously returns, in a manner roughly analogous to how a liquid can **freeze** into a crystalline solid.

22.3.4 Antiferromagnetism

Main article: [Antiferromagnetism](#)

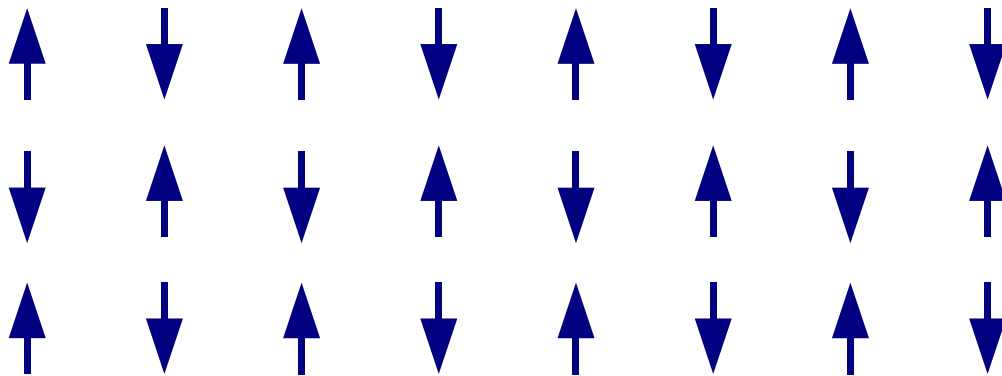
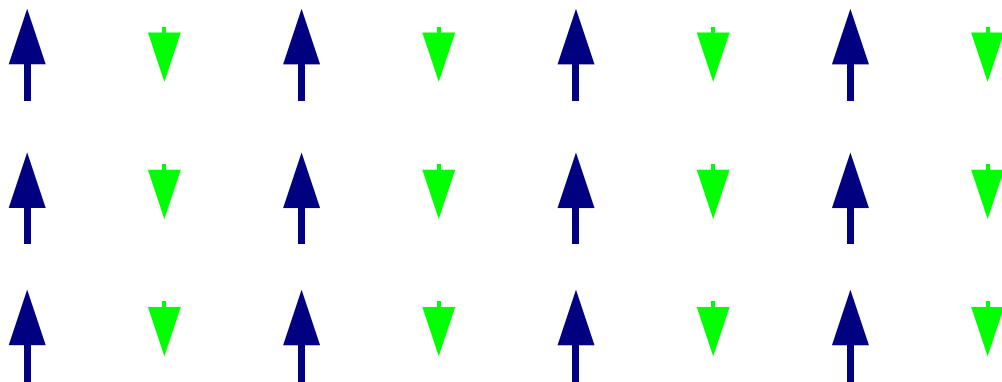
In an antiferromagnet, unlike a ferromagnet, there is a tendency for the intrinsic magnetic moments of neighboring valence electrons to point in *opposite* directions. When all atoms are arranged in a substance so that each neighbor is 'anti-aligned', the substance is **antiferromagnetic**. Antiferromagnets have a zero net magnetic moment, meaning no field is produced by them. Antiferromagnets are less common compared to the other types of behaviors, and are mostly observed at low temperatures. In varying temperatures, antiferromagnets can be seen to exhibit diamagnetic and ferromagnetic properties.

In some materials, neighboring electrons want to point in opposite directions, but there is no geometrical arrangement in which *each* pair of neighbors is anti-aligned. This is called a **spin glass**, and is an example of **geometrical frustration**.

22.3.5 Ferrimagnetism

Main article: [Ferrimagnetism](#)

Like ferromagnetism, **ferrimagnets** retain their magnetization in the absence of a field. However, like antiferromagnets, neighboring pairs of electron spins tend to point in opposite directions. These two properties are not con-

*Antiferromagnetic ordering**Ferrimagnetic ordering*

tradictory, because in the optimal geometrical arrangement, there is more magnetic moment from the sublattice of electrons that point in one direction, than from the sublattice that points in the opposite direction.

Most **ferrites** are ferrimagnetic. The first discovered magnetic substance, **magnetite**, is a ferrite and was originally believed to be a ferromagnet; **Louis Néel** disproved this, however, after discovering ferrimagnetism.

22.3.6 Superparamagnetism

Main article: [Superparamagnetism](#)

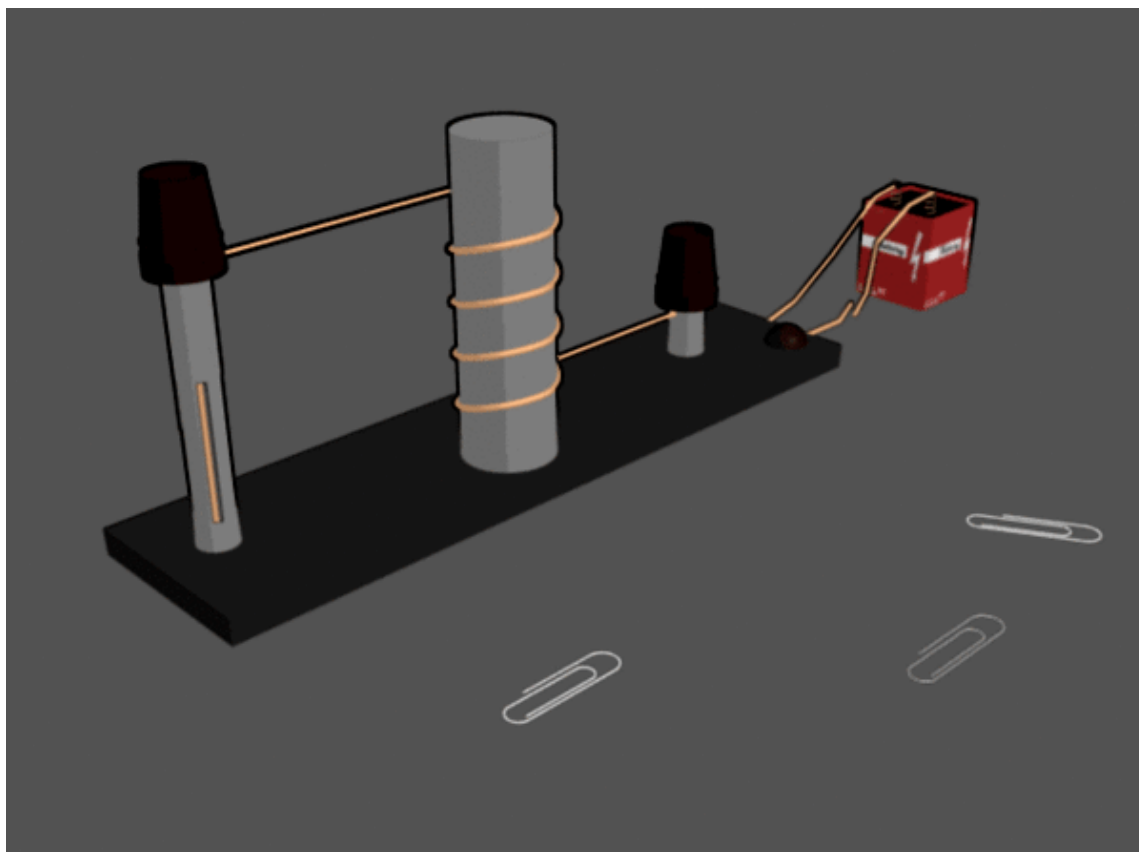
When a ferromagnet or ferrimagnet is sufficiently small, it acts like a single magnetic spin that is subject to **Brownian motion**. Its response to a magnetic field is qualitatively similar to the response of a paramagnet, but much larger.

22.3.7 Other types of magnetism

- **Metamagnetism**

- Molecule-based magnet
- Spin glass

22.4 Electromagnet



An electromagnet attracts paper clips when current is applied creating a magnetic field. The electromagnet loses them when current and magnetic field are removed.

An **electromagnet** is a type of **magnet** in which the **magnetic field** is produced by an **electric current**. The magnetic field disappears when the current is turned off. Electromagnets usually consist of a large number of closely spaced turns of wire that create the magnetic field. The wire turns are often wound around a **magnetic core** made from a **ferromagnetic** or **ferrimagnetic** material such as **iron**; the magnetic core concentrates the **magnetic flux** and makes a more powerful magnet.

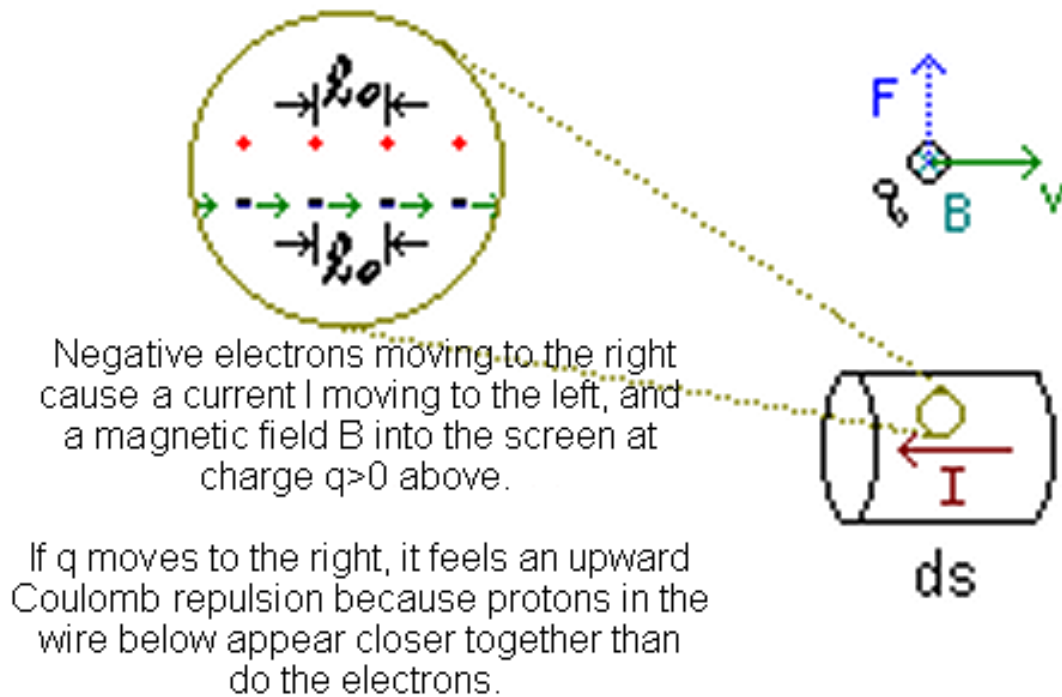
The main advantage of an electromagnet over a **permanent magnet** is that the magnetic field can be quickly changed by controlling the amount of electric current in the winding. However, unlike a permanent magnet that needs no power, an electromagnet requires a continuous supply of current to maintain the magnetic field.

Electromagnets are widely used as components of other electrical devices, such as **motors**, **generators**, **relays**, **loudspeakers**, **hard disks**, **MRI machines**, scientific instruments, and **magnetic separation** equipment. Electromagnets are also employed in industry for picking up and moving heavy iron objects such as scrap iron and steel.*[11] Electromagnetism was discovered in 1820.*[12]

22.5 Magnetism, electricity, and special relativity

Main article: **Classical electromagnetism and special relativity**

As a consequence of Einstein's theory of special relativity, electricity and magnetism are fundamentally interlinked. Both magnetism lacking electricity, and electricity without magnetism, are inconsistent with special relativity, due to



Magnetism from length-contraction.

such effects as **length contraction**, **time dilation**, and the fact that the **magnetic force** is velocity-dependent. However, when both electricity and magnetism are taken into account, the resulting theory (**electromagnetism**) is fully consistent with special relativity.* [8] [13] In particular, a phenomenon that appears purely electric or purely magnetic to one observer may be a mix of both to another, or more generally the relative contributions of electricity and magnetism are dependent on the frame of reference. Thus, special relativity “mixes” electricity and magnetism into a single, inseparable phenomenon called **electromagnetism**, analogous to how relativity “mixes” space and time into **spacetime**.

All observations on **electromagnetism** apply to what might be considered to be primarily magnetism, e.g. perturbations in the magnetic field are necessarily accompanied by a nonzero electric field, and propagate at the **speed of light**.

22.6 Magnetic fields in a material

See also: **Magnetic field § H and B inside and outside of magnetic materials**

In a vacuum,

$$\mathbf{B} = \mu_0 \mathbf{H},$$

where μ_0 is the **vacuum permeability**.

In a material,

$$\mathbf{B} = \mu_0 (\mathbf{H} + \mathbf{M}).$$

The quantity $\mu_0 \mathbf{M}$ is called *magnetic polarization*.

If the field \mathbf{H} is small, the response of the magnetization \mathbf{M} in a **diamagnet** or **paramagnet** is approximately linear:

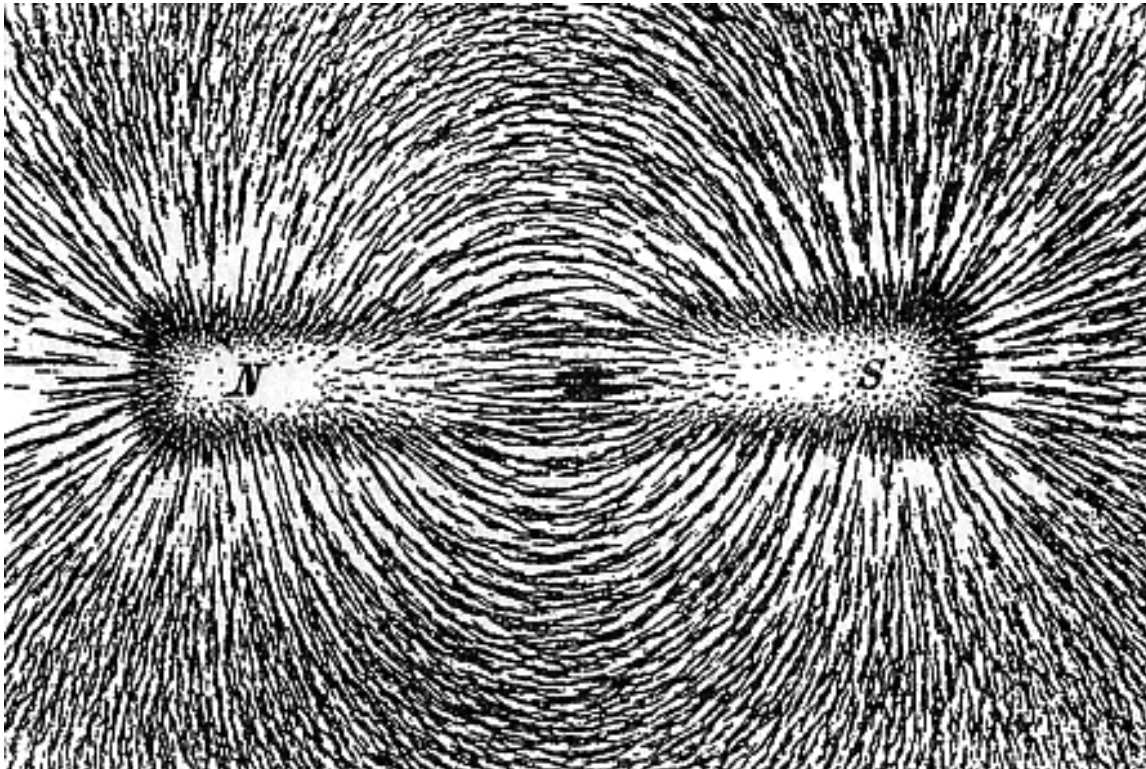
$$\mathbf{M} = \chi \mathbf{H},$$

the constant of proportionality being called the magnetic susceptibility. If so,

$$\mu_0(\mathbf{H} + \mathbf{M}) = \mu_0(1 + \chi)\mathbf{H} = \mu_r\mu_0\mathbf{H} = \mu\mathbf{H}.$$

In a hard magnet such as a ferromagnet, \mathbf{M} is not proportional to the field and is generally nonzero even when \mathbf{H} is zero (see [Remanence](#)).

22.7 Magnetic force



Magnetic lines of force of a bar magnet shown by iron filings on paper

Main article: [Magnetic field](#)

The phenomenon of magnetism is “mediated” by the magnetic field. An electric current or magnetic dipole creates a magnetic field, and that field, in turn, imparts magnetic forces on other particles that are in the fields.

Maxwell's equations, which simplify to the [Biot–Savart law](#) in the case of steady currents, describe the origin and behavior of the fields that govern these forces. Therefore, magnetism is seen whenever electrically [charged particles](#) are in [motion](#)—for example, from movement of electrons in an [electric current](#), or in certain cases from the orbital motion of electrons around an atom's nucleus. They also arise from “intrinsic” [magnetic dipoles](#) arising from quantum-mechanical [spin](#).

The same situations that create magnetic fields—charge moving in a current or in an atom, and intrinsic magnetic dipoles—are also the situations in which a magnetic field has an effect, creating a force. Following is the formula for moving charge; for the forces on an intrinsic dipole, see [magnetic dipole](#).

When a charged particle moves through a [magnetic field](#) \mathbf{B} , it feels a [Lorentz force](#) \mathbf{F} given by the [cross product](#).^{*[14]}

$$\mathbf{F} = q(\mathbf{v} \times \mathbf{B})$$

where

q is the electric charge of the particle, and

\mathbf{v} is the **velocity vector** of the particle

Because this is a cross product, the force is **perpendicular** to both the motion of the particle and the magnetic field. It follows that the magnetic force does no **work** on the particle; it may change the direction of the particle's movement, but it cannot cause it to speed up or slow down. The magnitude of the force is

$$F = qvB \sin \theta$$

where θ is the angle between \mathbf{v} and \mathbf{B} .

One tool for determining the direction of the velocity vector of a moving charge, the magnetic field, and the force exerted is labeling the **index finger** “ \mathbf{V} ”, the **middle finger** “ \mathbf{B} ”, and the **thumb** “ \mathbf{F} ” with your right hand. When making a gun-like configuration, with the middle finger crossing under the index finger, the fingers represent the velocity vector, magnetic field vector, and force vector, respectively. See also **right hand rule**.

22.8 Magnetic dipoles

Main article: **Magnetic dipole**

A very common source of magnetic field found in nature is a **dipole**, with a “**South pole**” and a “**North pole**”, terms dating back to the use of magnets as compasses, interacting with the **Earth's magnetic field** to indicate North and South on the **globe**. Since opposite ends of magnets are attracted, the north pole of a magnet is attracted to the south pole of another magnet. The Earth's **North Magnetic Pole** (currently in the Arctic Ocean, north of Canada) is physically a south pole, as it attracts the north pole of a compass. A magnetic field contains **energy**, and physical systems move toward configurations with lower energy. When diamagnetic material is placed in a magnetic field, a *magnetic dipole* tends to align itself in opposed polarity to that field, thereby lowering the net field strength. When ferromagnetic material is placed within a magnetic field, the magnetic dipoles align to the applied field, thus expanding the domain walls of the magnetic domains.

22.8.1 Magnetic monopoles

Main article: **Magnetic monopole**

Since a bar magnet gets its ferromagnetism from electrons distributed evenly throughout the bar, when a bar magnet is cut in half, each of the resulting pieces is a smaller bar magnet. Even though a magnet is said to have a north pole and a south pole, these two poles cannot be separated from each other. A monopole—if such a thing exists—would be a new and fundamentally different kind of magnetic object. It would act as an isolated north pole, not attached to a south pole, or vice versa. Monopoles would carry “magnetic charge” analogous to electric charge. Despite systematic searches since 1931, as of 2010, they have never been observed, and could very well not exist.*[15]

Nevertheless, some **theoretical physics** models predict the existence of these **magnetic monopoles**. Paul Dirac observed in 1931 that, because electricity and magnetism show a certain **symmetry**, just as **quantum theory** predicts that individual **positive** or **negative** electric charges can be observed without the opposing charge, isolated South or North magnetic poles should be observable. Using quantum theory Dirac showed that if magnetic monopoles exist, then one could explain the quantization of electric charge—that is, why the observed **elementary particles** carry charges that are multiples of the charge of the electron.

Certain **grand unified theories** predict the existence of monopoles which, unlike elementary particles, are **solitons** (localized energy packets). The initial results of using these models to estimate the number of monopoles created in the **big bang** contradicted cosmological observations—the monopoles would have been so plentiful and massive that they would have long since halted the expansion of the universe. However, the idea of **inflation** (for which this problem served as a partial motivation) was successful in solving this problem, creating models in which monopoles existed but were rare enough to be consistent with current observations.*[16]

22.9 Quantum-mechanical origin of magnetism

In principle all kinds of magnetism originate from specific quantum-mechanical phenomena (e.g. **Mathematical formulation of quantum mechanics**, in particular the chapters on **spin** and on the **Pauli principle**). A successful model was developed already in 1927, by **Walter Heitler** and **Fritz London**, who derived quantum-mechanically, how hydrogen molecules are formed from hydrogen atoms, i.e. from the atomic hydrogen orbitals u_A and u_B centered at the nuclei A and B , see below. That this leads to magnetism is not at all obvious, but will be explained in the following.

According to the Heitler-London theory, so-called two-body molecular σ -orbitals are formed, namely the resulting orbital is:

$$\psi(\mathbf{r}_1, \mathbf{r}_2) = \frac{1}{\sqrt{2}} (u_A(\mathbf{r}_1)u_B(\mathbf{r}_2) + u_B(\mathbf{r}_1)u_A(\mathbf{r}_2))$$

Here the last product means that a first electron, \mathbf{r}_1 , is in an atomic hydrogen-orbital centered at the second nucleus, whereas the second electron runs around the first nucleus. This “exchange” phenomenon is an expression for the quantum-mechanical property that particles with identical properties cannot be distinguished. It is specific not only for the formation of **chemical bonds**, but as we will see, also for magnetism, i.e. in this connection the term **exchange interaction** arises, a term which is essential for the origin of magnetism, and which is stronger, roughly by factors 100 and even by 1000, than the energies arising from the electrodynamic dipole-dipole interaction.

As for the *spin function* $\chi(s_1, s_2)$, which is responsible for the magnetism, we have the already mentioned Pauli's principle, namely that a symmetric orbital (i.e. with the + sign as above) must be multiplied with an antisymmetric spin function (i.e. with a – sign), and *vice versa*. Thus:

$$\chi(s_1, s_2) = \frac{1}{\sqrt{2}} (\alpha(s_1)\beta(s_2) - \beta(s_1)\alpha(s_2))$$

I.e., not only u_A and u_B must be substituted by α and β , respectively (the first entity means “spin up”, the second one “spin down”), but also the sign + by the – sign, and finally \mathbf{r}_i by the discrete values $s_i (= \pm 1/2)$; thereby we have $\alpha(+1/2) = \beta(-1/2) = 1$ and $\alpha(-1/2) = \beta(+1/2) = 0$. The “**singlet state**”, i.e. the – sign, means: the spins are *antiparallel*, i.e. for the solid we have **antiferromagnetism**, and for two-atomic molecules one has **diamagnetism**. The tendency to form a (homoeopolar) chemical bond (this means: the formation of a *symmetric* molecular orbital, i.e. with the + sign) results through the Pauli principle automatically in an *antisymmetric* spin state (i.e. with the – sign). In contrast, the Coulomb repulsion of the electrons, i.e. the tendency that they try to avoid each other by this repulsion, would lead to an *antisymmetric* orbital function (i.e. with the – sign) of these two particles, and complementary to a *symmetric* spin function (i.e. with the + sign, one of the so-called “**triplet functions**”). Thus, now the spins would be *parallel* (**ferromagnetism** in a solid, **paramagnetism** in two-atomic gases).

The last-mentioned tendency dominates in the metals **iron**, **cobalt** and **nickel**, and in some rare earths, which are *ferromagnetic*. Most of the other metals, where the first-mentioned tendency dominates, are *nonmagnetic* (e.g. **sodium**, **aluminium**, and **magnesium**) or *antiferromagnetic* (e.g. **manganese**). Diatomic gases are also almost exclusively diamagnetic, and not paramagnetic. However, the oxygen molecule, because of the involvement of π -orbitals, is an exception important for the life-sciences.

The Heitler-London considerations can be generalized to the **Heisenberg model** of magnetism (Heisenberg 1928).

The explanation of the phenomena is thus essentially based on all subtleties of quantum mechanics, whereas the electrodynamics covers mainly the phenomenology.

22.10 Units

22.10.1 SI

22.10.2 Other

- **gauss** – the centimeter-gram-second (CGS) unit of magnetic field (denoted **B**)
- **oersted** – the CGS unit of magnetizing field (denoted **H**)

- maxwell – the CGS unit for magnetic flux
- gamma – a unit of *magnetic flux density* that was commonly used before the tesla came into use (1.0 gamma = 1.0 nanotesla)
- μ_0 – common symbol for the permeability of free space ($4\pi \times 10^{-7}$ newton/(ampere-turn)²)

22.11 Living things

Some organisms can detect magnetic fields, a phenomenon known as **magnetoception**. In addition to detection, bio-magnetic phenomena is utilized by organisms in a number of ways. For instance, **chitons**, a type of marine mollusk, produce magnetite to harden their teeth, and even humans produce magnetite in bodily tissue.* [18] **Magnetobiology** studies magnetic fields as a **medical** treatment; fields naturally produced by an organism are known as **biomagnetism**.

22.12 See also

- Coercivity
- Gravitomagnetism
- Magnetic hysteresis
- Magnetar
- Magnetic bearing
- Magnetic circuit
- Magnetic cooling
- Magnetic field viewing film
- Magnetic stirrer
- Magnetic structure
- Magnetism and temperature
- Micromagnetism
- Neodymium magnet
- Plastic magnet
- Rare-earth magnet
- Spin wave
- Spontaneous magnetization
- Vibrating sample magnetometer

22.13 References

- [1] Du Trémolet de Lacheisserie, Étienne; Damien Gignoux; Michel Schlenker (2005). *Magnetism: Fundamentals*. Springer. pp. 3–6. ISBN 0-387-22967-1.
- [2] Fowler, Michael (1997). “Historical Beginnings of Theories of Electricity and Magnetism” . Retrieved 2008-04-02.
- [3] Vowles, Hugh P. (1932). “Early Evolution of Power Engineering” . *Isis*. University of Chicago Press. **17** (2): 412–420 [419–20]. doi:10.1086/346662.

- [4] The section “Fanying 2” (反應第二) of *The Guiguzi*: “其察言也，不失若磁石之取鍼，舌之取燔骨”.
- [5] Li, Shu-hua (1954). “Origine de la Boussole II. Aimant et Boussole”. *Isis* (in French). **45** (2): 175–196. JSTOR 227361. un passage dans le *Liu-che-ich'ouen-ts'ieou* [...]: “La pierre d'aimant fait venir le fer ou elle l'attire.”
From the section “Jingtong” (精通) of the “Almanac of the Last Autumn Month” (季秋紀): “慈石召鐵，或引之也”]
- [6] In the section “A Last Word on Dragons” (亂龍篇 *Luanlong*) of the *Lunheng*: “Amber takes up straws, and a load-stone attracts needles” (頓牟掇芥，磁石引針).
- [7] Schmidl, Petra G. (1996–1997). “Two Early Arabic Sources On The Magnetic Compass”. *Journal of Arabic and Islamic Studies*. **1**: 81–132.
- [8] A. Einstein: “On the Electrodynamics of Moving Bodies”, June 30, 1905.
- [9] HP Meyers (1997). *Introductory solid state physics* (2 ed.). CRC Press. p. 362; Figure 11.1. ISBN 9781420075021.
- [10] Catherine Westbrook; Carolyn Kaut; Carolyn Kaut-Roth (1998). *MRI (Magnetic Resonance Imaging) in practice* (2 ed.). Wiley-Blackwell. p. 217. ISBN 0-632-04205-2.
- [11] Merzouki, Rochdi; Samantaray, Arun Kumar; Pathak, Pushparaj Mani (2012). *Intelligent Mechatronic Systems: Modeling, Control and Diagnosis*. Springer Science & Business Media. pp. 403–405. ISBN 144714628X.
- [12] Sturgeon, W. (1825). “Improved Electro Magnetic Apparatus”. *Trans. Royal Society of Arts, Manufactures, & Commerce*. London. **43**: 37–52. cited in Miller, T.J.E (2001). *Electronic Control of Switched Reluctance Machines*. Newnes. p. 7. ISBN 0-7506-5073-7.
- [13] Griffiths 1998, chapter 12
- [14] Jackson, John David (1999). *Classical electrodynamics* (3rd ed.). New York: Wiley. ISBN 0-471-30932-X.
- [15] Milton mentions some inconclusive events (p.60) and still concludes that “no evidence at all of magnetic monopoles has survived”(p.3). Milton, Kimball A. (June 2006). “Theoretical and experimental status of magnetic monopoles”. *Reports on Progress in Physics*. **69** (6): 1637–1711. arXiv:hep-ex/0602040  Bibcode:2006RPPh...69.1637M. doi:10.1088/0034-4885/69/6/R02..
- [16] Guth, Alan (1997). *The Inflationary Universe: The Quest for a New Theory of Cosmic Origins*. Perseus. ISBN 0-201-32840-2. OCLC 38941224..
- [17] International Union of Pure and Applied Chemistry (1993). *Quantities, Units and Symbols in Physical Chemistry*, 2nd edition, Oxford: Blackwell Science. ISBN 0-632-03583-8. pp. 14–15. Electronic version.
- [18] Kirschvink, Joseph L.; Kobayashi-Kirschvink, Atsuko; Diaz-Ricci, Juan C.; Kirschvink, Steven J. (1992). “Magnetite in Human Tissues: A Mechanism for the Biological Effects of Weak ELF Magnetic Fields” (PDF). *Bioelectromagnetics Supplement*. **1**: 101–113. Retrieved 29 March 2016.

22.14 Further reading

- Furlani, Edward P. (2001). *Permanent Magnet and Electromechanical Devices: Materials, Analysis and Applications*. Academic Press. ISBN 0-12-269951-3. OCLC 162129430.
- Griffiths, David J. (1998). *Introduction to Electrodynamics* (3rd ed.). Prentice Hall. ISBN 0-13-805326-X. OCLC 40251748.
- Kronmüller, Helmut. (2007). *Handbook of Magnetism and Advanced Magnetic Materials, 5 Volume Set*. John Wiley & Sons. ISBN 978-0-470-02217-7. OCLC 124165851.
- Tipler, Paul (2004). *Physics for Scientists and Engineers: Electricity, Magnetism, Light, and Elementary Modern Physics* (5th ed.). W. H. Freeman. ISBN 0-7167-0810-8. OCLC 51095685.
- David K. Cheng (1992). *Field and Wave Electromagnetics*. Addison-Wesley Publishing Company, Inc. ISBN 0-201-12819-5.

22.15 External links

-
- [Magnetism on *In Our Time* at the BBC. \(listen now\)](#)
- [The Exploratorium Science Snacks – Snacks about Magnetism](#)
- [Electromagnetism](#) - a chapter from an online textbook
- [Video: The physicist Richard Feynman answers the question, Why do bar magnets attract or repel each other? on YouTube](#)
- [On the Magnet, 1600](#) First scientific book on magnetism by the father of electrical engineering. Full English text, full text search.
- [Magnetism and magnetization](#) - Astronoo

Chapter 23

Mahabharata

This article is about the Sanskrit epic. For other uses, see [Mahabharata \(disambiguation\)](#).



Krishna and Arjuna at Kurukshetra, 18th–19th-century painting

The ***Mahābhārata*** (Sanskrit: महाभारतम्, *Mahābhāratam*, pronounced [məɦaːˈbʱaːrət̪əm]) is one of the two major Sanskrit epics of ancient India, the other being the *Rāmāyaṇa*.* [1]

The *Mahābhārata* is an epic narrative of the Kurukṣetra War and the fates of the Kaurava and the Pāṇḍava princes. It also contains philosophical and devotional material, such as a discussion of the four “goals of life” or *puruṣārtha* (12.161). Among the principal works and stories in the *Mahābhārata* are the *Bhagavadgītā*, the story of Damayantī, an abbreviated version of the *Rāmāyaṇa*, and the story of R̥ṣyasringa, often considered as works in their own right.

Traditionally, the authorship of the *Mahābhārata* is attributed to Vyāsa. There have been many attempts to unravel its historical growth and compositional layers. The oldest preserved parts of the text are thought to be not much older than around 400 BCE, though the origins of the epic probably fall between the 8th and 9th centuries BCE.* [2] The text probably reached its final form by the early Gupta period (c. 4th century CE).* [3] The title may be translated as

“the great tale of the Bhārata dynasty” . According to the *Mahābhārata* itself, the tale is extended from a shorter version of 24,000 verses called simply *Bhārata*.^[4]

The *Mahābhārata* is the longest epic poem known and has been described as “the longest poem ever written” .^[5]^[6] Its longest version consists of over 100,000 *śloka* or over 200,000 individual verse lines (each *śloka* is a couplet), and long prose passages. About 1.8 million words in total, the *Mahābhārata* is roughly ten times the length of the *Iliad* and the *Odyssey* combined, or about four times the length of the *Rāmāyaṇa*.^[7]^[8] W. J. Johnson has compared the importance of the *Mahābhārata* in the context of world civilization to that of the Bible, the works of Shakespeare, the works of Homer, Greek drama, or the Qur'an.^[9]

23.1 Textual history and structure



Modern depiction of Vyasa narrating the *Mahābhārata* to Ganesha at the Murudeshwara temple, Karnataka.

The epic is traditionally ascribed to the sage Vyāsa, who is also a major character in the epic. Vyāsa described it as being *itihāsa* (history). He also describes the Guru-shishya parampara, which traces all great teachers and their students of the Vedic times.

The first section of the *Mahābhārata* states that it was Gaṇeśa who wrote down the text to Vyasa's dictation.

The epic employs the story within a story structure, otherwise known as *frametales*, popular in many Indian religious and non-religious works. It is first recited at *Takshashila* by the sage Vaiśampāyana,^[10]^[11] a disciple of Vyāsa, to the King Janamejaya who is the great-grandson of the Pāṇḍava prince Arjuna. The story is then recited again by a professional storyteller named Ugrasrava Sauti, many years later, to an assemblage of sages performing the 12-year sacrifice for the king Saunaka Kulapati in the Naimiśa Forest.

The text has been described by some early 20th-century western Indologists as unstructured and chaotic. Hermann Oldenberg supposed that the original poem must once have carried an immense “tragic force” but dismissed the full text as a “horrible chaos.”^[12] Moritz Winternitz (*Geschichte der indischen Literatur* 1909) considered that “only unpoetical theologians and clumsy scribes” could have lumped the parts of disparate origin into an unordered whole.^[13]

23.1.1 Accretion and redaction

Research on the Mahābhārata has put an enormous effort into recognizing and dating layers within the text. Some elements of the present Mahābhārata can be traced back to Vedic times. ^[14] The background to the Mahābhārata suggests the origin of the epic occurs “after the very early Vedic period” and before “the first Indian 'empire' was to rise in the third century B.C.” That this is “a date not too far removed from the 8th or 9th century B.C.” ^[2] ^[15] is likely. Mahābhārata started as an orally-transmitted tale of the charioteer bards. ^[16] It is generally agreed that “Unlike the Vedas, which have to be preserved letter-perfect, the epic was a popular work whose reciters would inevitably conform to changes in language and style,” ^[15] so the earliest 'surviving' components of this dynamic text are believed to be no older than the earliest 'external' references we have to the epic, which may include an allusion in Panini's 4th century BCE grammar Aṣṭādhyāyī 4:2:56. ^[2] ^[15] It is estimated that the Sanskrit text probably reached something of a “final form” by the early Gupta period (about the 4th century CE). ^[15] Vishnu Sukthankar, editor of the first great critical edition of the Mahābhārata, commented: “It is useless to think of reconstructing a fluid text in a literally original shape, on the basis of an archetype and a *stemma codicum*. What then is possible? Our objective can only be to reconstruct the oldest form of the text which it is possible to reach on the basis of the manuscript material available.” ^[17] That manuscript evidence is somewhat late, given its material composition and the climate of India, but it is very extensive.

The Mahābhārata itself (1.1.61) distinguishes a core portion of 24,000 verses: the *Bhārata* proper, as opposed to additional secondary material, while the *Aśvalāyana Gr̥hyasūtra* (3.4.4) makes a similar distinction. At least three redactions of the text are commonly recognized: *Jaya* (Victory) with 8,800 verses attributed to Vyāsa, *Bhārata* with 24,000 verses as recited by Vaiśampāyana, and finally the Mahābhārata as recited by Ugrasrava Sauti with over 100,000 verses. ^[18] ^[19] However, some scholars, such as John Brockington, argue that *Jaya* and *Bharata* refer to the same text, and ascribe the theory of *Jaya* with 8,800 verses to a misreading of a verse in *Ādiparvan* (1.1.81). ^[20] The redaction of this large body of text was carried out after formal principles, emphasizing the numbers 18 ^[21] and 12. The addition of the latest parts may be dated by the absence of the *Anuśāsana-parva* and the *Virāta parva* from the “Spitzer manuscript”. ^[22] The oldest surviving Sanskrit text dates to the Kushan Period (200 CE). ^[23]

According to what one character says at Mbh. 1.1.50, there were three versions of the epic, beginning with *Manu* (1.1.27), *Astika* (1.3, sub-parva 5) or *Vasu* (1.57), respectively. These versions would correspond to the addition of one and then another 'frame' settings of dialogues. The *Vasu* version would omit the frame settings and begin with the account of the birth of Vyasa. The *astika* version would add the *sarpasattra* and *aśvamedha* material from Brahmanical literature, introduce the name *Mahābhārata*, and identify Vyāsa as the work's author. The redactors of these additions were probably Pāṇicarātrin scholars who according to Oberlies (1998) likely retained control over the text until its final redaction. Mention of the *Huna* in the *Bhīṣma-parva* however appears to imply that this parva may have been edited around the 4th century.

The Ādi-parva includes the snake sacrifice (*sarpasattra*) of Janamejaya, explaining its motivation, detailing why all snakes in existence were intended to be destroyed, and why in spite of this, there are still snakes in existence. This *sarpasattra* material was often considered an independent tale added to a version of the Mahābhārata by “thematic attraction” (Minkowski 1991), and considered to have a particularly close connection to Vedic (Brahmana) literature. The Pāṇcavimśa Brahmana (at 25.15.3) enumerates the officiant priests of a *sarpasattra* among whom the names Dhṛtarāṣṭra and Janamejaya, two main characters of the Mahābhārata's *sarpasattra*, as well as Takṣaka, the name of a snake in the Mahābhārata, occur. ^[24]

23.1.2 Historical references

See also: Bhagavad Gita § Date and text

The earliest known references to the Mahābhārata and its core *Bhārata* date to the Aṣṭādhyāyī (sutra 6.2.38) of Pāṇini (fl. 4th century BCE) and in the *Aśvalāyana Gr̥hyasūtra* (3.4.4). This may mean the core 24,000 verses, known as the *Bhārata*, as well as an early version of the extended Mahābhārata, were composed by the 4th century BCE. A report by the Greek writer Dio Chrysostom (c. 40 - c. 120 CE) about Homer's poetry being sung even in India ^[25] seems to imply that the *Iliad* had been translated into Sanskrit. However, Indian scholars have, in general, taken this as evidence for the existence of a Mahābhārata at this date, whose episodes Dio or his sources identify with the story of the *Iliad*. ^[26]

Several stories within the Mahābhārata took on separate identities of their own in Classical Sanskrit literature. For instance, *Abhijñānaśākuntala* by the renowned Sanskrit poet Kālidāsa (c. 400 CE), believed to have lived in the era



The snake sacrifice of Janamejaya

of the Gupta dynasty, is based on a story that is the precursor to the *Mahābhārata*. *Urubhaṅga*, a Sanskrit play written by Bhāsa who is believed to have lived before Kālidāsa, is based on the slaying of Duryodhana by the splitting of his thighs by Bhīma.

The copper-plate inscription of the Maharaja Sharvanatha (533–534 CE) from Khoh (Satna District, Madhya Pradesh)

describes the Mahābhārata as a “collection of 100,000 verses” (*śata-sahasri saṃhitā*).

23.1.3 The 18 parvas or books

The division into 18 parvas is as follows:

23.2 Historical context

Further information: [Bharata Khanda](#)

The historicity of the **Kurukshetra War** is unclear. Many historians estimate the date of the Kurukshetra war to **Iron Age India** of the 10th century BCE. ^[30] The setting of the epic has a historical precedent in Iron Age (**Vedic**) India, where the **Kuru** kingdom was the center of political power during roughly 1200 to 800 BCE. ^[31] A dynastic conflict of the period could have been the inspiration for the *Jaya*, the foundation on which the Mahābhārata corpus was built, with a climactic battle eventually coming to be viewed as an epochal event.

Puranic literature presents genealogical lists associated with the Mahābhārata narrative. The evidence of the Puranas is of two kinds. Of the first kind, there is the direct statement that there were 1015 (or 1050) years between the birth of **Parikshit** (Arjuna's grandson) and the accession of **Mahapadma Nanda** (400-329 BCE), which would yield an estimate of about 1400 BCE for the Bharata battle. ^[32] However, this would imply improbably long reigns on average for the kings listed in the genealogies. ^[33] Of the second kind are analyses of parallel genealogies in the Puranas between the times of Adhisimakrishna (**Parikshit's** great-grandson) and **Mahapadma Nanda**. Pargiter accordingly estimated 26 generations by averaging 10 different dynastic lists and, assuming 18 years for the average duration of a reign, arrived at an estimate of 850 BCE for Adhisimakrishna, and thus approximately 950 BCE for the Bharata battle. ^[34]



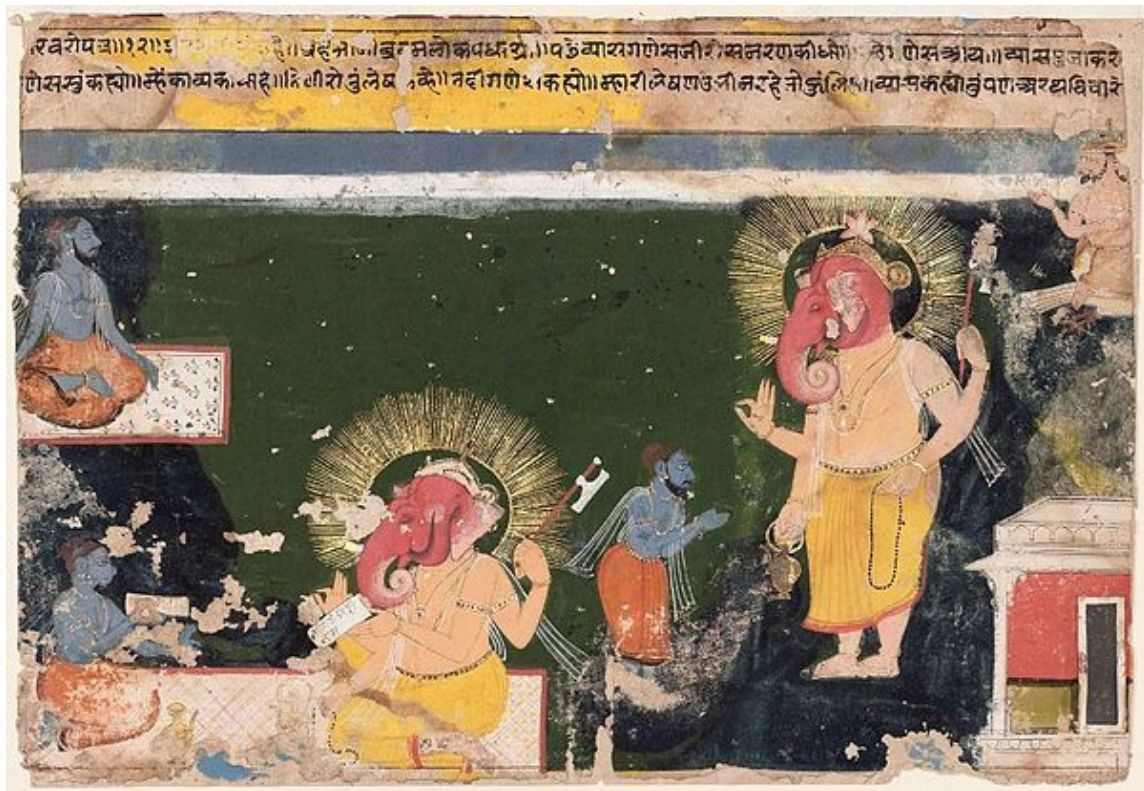
Map of some *Painted Grey Ware* (PGW) sites.

B. B. Lal used the same approach with a more conservative assumption of the average reign to estimate a date of 836 BCE, and correlated this with archaeological evidence from **Painted Grey Ware** (PGW) sites, the association being

strong between PGW artifacts and places mentioned in the epic. * [35] John Keay confirm this and also gives 950 BCE for the Bharata battle. * [36]

Attempts to date the events using methods of *archaeoastronomy* have produced, depending on which passages are chosen and how they are interpreted, estimates ranging from the late 4th to the mid-2nd millennium BCE. * [37] The late 4th millennium date has a precedent in the calculation of the Kaliyuga epoch, based on planetary conjunctions, by *Aryabhata* (6th century). Aryabhata's date of February 18 3102 BCE for Mahābhārata war has become widespread in Indian tradition. Some sources mark this as the disappearance of *Krishna* from earth. * [38] The *Aihole inscription* of *Pulikeshi II*, dated to Saka 556 = 634 CE, claims that 3735 years have elapsed since the Bharata battle, putting the date of Mahābhārata war at 3137 BCE. * [39] * [40] Another traditional school of astronomers and historians, represented by *Vridhha-Garga*, *Varahamihira* (author of the *Brhatsamhita*) and *Kalhana* (author of the *Rajatarangini*), place the Bharata war 653 years after the Kaliyuga epoch, corresponding to 2449 BCE. * [41]

23.3 Synopsis



Ganesha writing the Mahabharata

The core story of the work is that of a dynastic struggle for the throne of *Hastinapura*, the kingdom ruled by the *Kuru* clan. The two collateral branches of the family that participate in the struggle are the *Kaurava* and the *Pandava*. Although the *Kaurava* is the senior branch of the family, *Duryodhana*, the eldest *Kaurava*, is younger than *Yudhishtira*, the eldest *Pandava*. Both *Duryodhana* and *Yudhishtira* claim to be first in line to inherit the throne.

The struggle culminates in the *great battle of Kurukshetra*, in which the *Pandavas* are ultimately victorious. The battle produces complex conflicts of kinship and friendship, instances of family loyalty and duty taking precedence over what is right, as well as the converse.

The Mahābhārata itself ends with the death of *Krishna*, and the subsequent end of his dynasty and ascent of the *Pandava* brothers to heaven. It also marks the beginning of the Hindu age of *Kali Yuga*, the fourth and final age of humankind, in which great values and noble ideas have crumbled, and people are heading towards the complete dissolution of right action, morality and virtue.

23.3.1 The older generations



Shantanu woos Satyawati, the fisherwoman. Painting by Raja Ravi Varma.

King Janamejaya's ancestor **Shantanu**, the king of **Hastinapura**, has a short-lived marriage with the goddess **Ganga** and has a son, Devavrata (later to be called **Bhishma**, a great warrior), who becomes the heir apparent. Many years later, when King Shantanu goes hunting, he sees **Satyavati**, the daughter of the chief of fisherman, and asks her father for her hand. Her father refuses to consent to the marriage unless Shantanu promises to make any future son of Satyavati the king upon his death. To resolve his father's dilemma, Devavrata agrees to relinquish his right to the throne. As the fisherman is not sure about the prince's children honouring the promise, Devavrata also takes a vow of lifelong celibacy to guarantee his father's promise.

Shantanu has two sons by Satyavati, **Chitrāngada** and **Vichitravirya**. Upon Shantanu's death, Chitrangada becomes king. He lives a very short uneventful life and dies. Vichitravirya, the younger son, rules **Hastinapura**. Meanwhile, the King of **Kāśī** arranges a **swayamvara** for his three daughters, neglecting to invite the royal family of Hastinapur. In order to arrange the marriage of young Vichitravirya, Bhishma attends the swayamvara of the three princesses Amba, Ambika and Ambalika, uninvited, and proceeds to abduct them. Ambika and Ambalika consent to be married to Vichitravirya.

The oldest princess Amba, however, informs Bhishma that she wishes to marry king of Shalva whom Bhishma defeated at their swayamvara. Bhishma lets her leave to marry king of Shalva, but Shalva refuses to marry her, still smarting at his humiliation at the hands of Bhishma. Amba then returns to marry Bhishma but he refuses due to his vow of celibacy. Amba becomes enraged and becomes Bhishma's bitter enemy, holding him responsible for her plight. Later she is reborn to King **Drupada** as **Shikhandi** (or Shikhandini) and causes Bhishma's fall, with the help of **Arjuna**, in the battle of Kurukshetra.

23.3.2 The Pandava and Kaurava princes

When Vichitravirya dies young without any heirs, Satyavati asks her first son **Vyasa** to father children with the widows. The eldest, Ambika, shuts her eyes when she sees him, and so her son **Dhritarashtra** is born blind. Ambalika turns pale and bloodless upon seeing him, and thus her son **Pandu** is born pale and unhealthy (the term Pandu may also mean 'jaundiced'*[42]). Due to the physical challenges of the first two children, Satyavati asks Vyasa to try once again. However, Ambika and Ambalika send their maid instead, to Vyasa's room. Vyasa fathers a third son, **Vidura**, by the maid. He is born healthy and grows up to be one of the wisest characters in the *Mahabharata*. He serves as Prime Minister (Mahamantri or Mahatma) to King Pandu and King Dhritarashtra.

When the princes grow up, Dhritarashtra is about to be crowned king by Bhishma when Vidura intervenes and uses his knowledge of politics to assert that a blind person cannot be king. This is because a blind man cannot control and protect his subjects. The throne is then given to Pandu because of Dhritarashtra's blindness. Pandu marries twice, to **Kunti** and **Madri**. Dhritarashtra marries **Gandhari**, a princess from Gandhara, who blindfolds herself so that she may feel the pain that her husband feels. Her brother **Shakuni** is enraged by this and vows to take revenge on the Kuru family. One day, when Pandu is relaxing in the forest, he hears the sound of a wild animal. He shoots an arrow in the direction of the sound. However the arrow hits the sage **Kindama**, who curses him that if he engages in a sexual act, he will die. Pandu then retires to the forest along with his two wives, and his brother Dhritarashtra rules thereafter, despite his blindness.

Pandu's older queen Kunti, however, had been given a boon by Sage Durvasa that she could invoke any god using a special mantra. Kunti uses this boon to ask **Dharma** the god of justice, **Vayu** the god of the wind, and **Indra** the lord of the heavens for sons. She gives birth to three sons, **Yudhishtira**, **Bhima**, and **Arjuna**, through these gods. Kunti shares her mantra with the younger queen **Madri**, who bears the twins **Nakula** and **Sahadeva** through the **Ashwini** twins. However, Pandu and Madri indulge in sex, and Pandu dies. Madri dies on his funeral pyre out of remorse. Kunti raises the five brothers, who are from then on usually referred to as the **Pandava** brothers.

Dhritarashtra has a hundred sons through **Gandhari**, all born after the birth of Yudhishtira. These are the **Kaurava** brothers, the eldest being **Duryodhana**, and the second **Dushasana**. Other Kaurava brothers were **Vikarna** and **Sukarna**. The rivalry and enmity between them and the Pandava brothers, from their youth and into manhood, leads to the **Kurukshetra** war.

23.3.3 Lakshagraha (the house of lac)

After the deaths of their mother (Madri) and father (Pandu), the Pandavas and their mother Kunti return to the palace of Hastinapur. Yudhishtira is made Crown Prince by Dhritarashtra, under considerable pressure from his kingdom. Dhritarashtra wanted his own son Duryodhana to become king and lets his ambition get in the way of preserving justice.



Draupadi with her five husbands - the Pandavas. The central figure is Yudhishtira; the two on the bottom are Bhima and Arjuna. Nakula and Sahadeva, the twins, are standing. Painting by Raja Ravi Varma, c. 1900.

Shakuni, Duryodhana and Dusasana plot to get rid of the Pandavas. Shakuni calls the architect Purochana to build a palace out of flammable materials like lac and ghee. He then arranges for the Pandavas and the Queen Mother Kunti to stay there, with the intention of setting it alight. However, the Pandavas are warned by their wise uncle, Vidura, who sends them a miner to dig a tunnel. They are able to escape to safety and go into hiding. Back at Hastinapur, the Pandavas and Kunti are presumed dead.*[43]

23.3.4 Marriage to Draupadi



Arjuna piercing the eye of the fish as depicted in Chennakesava Temple built by Hoysala Empire

Whilst they were in hiding the Pandavas learn of a *swayamvara* which is taking place for the hand of the Pāñcālā princess *Draupadī*. The Pandavas enter the competition in disguise as Brahmins. The task is to string a mighty steel bow and shoot a target on the ceiling, which is the eye of a moving artificial fish, while looking at its reflection in oil below. Most of the princes fail, many being unable to lift the bow. Arjuna succeeds however. The Pandavas return home and inform their mother that Arjuna has won a competition and to look at what they have brought back. Without looking, Kunti asks them to share whatever it is Arjuna has won among themselves. On explaining the previous life of Draupadi, she ends up being the wife of all five brothers.

23.3.5 Indraprastha

After the wedding, the Pandava brothers are invited back to Hastinapura. The Kuru family elders and relatives negotiate and broker a split of the kingdom, with the Pandavas obtaining a new territory. Yudhishtira has a new capital built for this territory at *Indraprastha*. Neither the Pandava nor Kaurava sides are happy with the arrangement however.

Shortly after this, Arjuna elopes with and then marries Krishna's sister, *Subhadra*. Yudhishtira wishes to establish his position as king; he seeks Krishna's advice. Krishna advises him, and after due preparation and the elimination of some opposition, Yudhishtira carries out the *rājasūya yagna* ceremony; he is thus recognised as pre-eminent among kings.

The Pandavas have a new palace built for them, by *Maya* the *Danava*.^[44] They invite their Kaurava cousins to Indraprastha. Duryodhana walks round the palace, and mistakes a glossy floor for water, and will not step in. After being told of his error, he then sees a pond, and assumes it is not water and falls in. *Draupadi* laughs at him and ridicules him by saying that this is because of his blind father *Dhritrashtra*. He then decides to avenge his humiliation.

23.3.6 The dice game



Draupadi humiliated

Shakuni, Duryodhana's uncle, now arranges a dice game, playing against Yudhishtira with loaded dice. Yudhishtira loses all his wealth, then his kingdom. He then even gambles his brothers, himself, and finally his wife into servitude.

The jubilant Kauravas insult the Pandavas in their helpless state and even try to disrobe Draupadi in front of the entire court, but her honour is saved by Krishna who miraculously creates lengths of cloth to replace the ones being removed.

Dhritarashtra, Bhishma, and the other elders are aghast at the situation, but Duryodhana is adamant that there is no place for two crown princes in Hastinapura. Against his wishes Dhritarashtra orders for another dice game. The Pandavas are required to go into exile for 12 years, and in the 13th year must remain hidden. If discovered by the Kauravas, they will be forced into exile for another 12 years.

23.3.7 Exile and return

The Pandavas spend thirteen years in exile; many adventures occur during this time. They also prepare alliances for a possible future conflict. They spend their final year in disguise in the court of **Virata**, and are discovered just after the end of the year.

At the end of their exile, they try to negotiate a return to Indraprastha. However, this fails, as Duryodhana objects that they were discovered while in hiding, and that no return of their kingdom was agreed. War becomes inevitable.

23.3.8 The battle at Kurukshetra

Main article: **Kurukshetra War**

The two sides summon vast armies to their help and line up at **Kurukshetra** for a war. The kingdoms of **Panchala**, **Dwaraka**, **Kasi**, **Kekaya**, **Magadha**, **Matsya**, **Chedi**, **Pandyas**, **Telinga**, and the **Yadus** of **Mathura** and some other clans like the **Parama Kambojas** were allied with the **Pandavas**. The allies of the **Kauravas** included the kings of **Pragjyotisha**, **Anga**, **Kekaya**, **Sindhudesa** (including **Sindhus**, **Sauviras** and **Sivis**), **Mahishmati**, **Avanti** in **Madhyadesa**, **Madra**, **Gandhara**, **Bahlika** people, **Kambojas** and many others. Before war being declared, **Balarama** had expressed his unhappiness at the developing conflict and left to go on pilgrimage; thus he does not take part in the battle itself. Krishna takes part in a non-combatant role, as charioteer for Arjuna.

Before the battle, Arjuna, seeing the opposing army includes many relatives and loved ones, including his great grandfather **Bhishma** and his teacher **Drona**, has doubts about the battle and he fails to lift his **Gāndeeva** bow. Krishna wakes him up to his call of duty in the famous **Bhagavad Gita** section of the epic.

Though initially sticking to chivalrous notions of warfare, both sides soon adopt dishonourable tactics. At the end of the 18-day battle, only the **Pandavas**, **Satyaki**, **Kripa**, **Ashwatthama**, **Kritavarma**, **Yuyutsu** and Krishna survive.

23.3.9 The end of the Pandavas

After “seeing” the carnage, **Gandhari**, who had lost all her sons, curses Krishna to be a witness to a similar annihilation of his family, for though divine and capable of stopping the war, he had not done so. Krishna accepts the curse, which bears fruit 36 years later.

The **Pandavas**, who had ruled their kingdom meanwhile, decide to renounce everything. Clad in skins and rags they retire to the **Himalaya** and climb towards heaven in their bodily form. A stray dog travels with them. One by one the brothers and Draupadi fall on their way. As each one stumbles, Yudhishtira gives the rest the reason for their fall (Draupadi was partial to Arjuna, Nakula and Sahadeva were vain and proud of their looks, and Bhima and Arjuna were proud of their strength and archery skills, respectively). Only the virtuous Yudhishtira, who had tried everything to prevent the carnage, and the dog remain. The dog reveals himself to be the god **Yama** (also known as **Yama Dharmaraja**), and then takes him to the underworld where he sees his siblings and wife. After explaining the nature of the test, Yama takes Yudhishtira back to heaven and explains that it was necessary to expose him to the underworld because (*Rajyante narakam dhruvam*) any ruler has to visit the underworld at least once. Yama then assures him that his siblings and wife would join him in heaven after they had been exposed to the underworld for measures of time according to their vices.

Arjuna's grandson **Parikshit** rules after them and dies bitten by a snake. His furious son, **Janamejaya**, decides to perform a snake sacrifice (*sarpasattra*) in order to destroy the snakes. It is at this sacrifice that the tale of his ancestors is narrated to him.



A scene from the Mahābhārata war, Angkor Wat: A black stone relief depicting a number of men wearing a crown and a dhoti, fighting with spears, swords and bows. A chariot with half the horse out of the frame is seen in the middle.

23.3.10 The reunion

The Mahābhārata mentions that Karna, the Pandavas, and Dhritarashtra's sons eventually ascended to svarga and “attained the state of the gods” and banded together — “serene and free from anger.” *[45]



Gandhari, blindfolded, supporting Dhrtarashtra and following Kunti when Dhrtarashtra became old and infirm and retired to the forest. A miniature painting from a 16th-century manuscript of part of the Razmnama, a Persian translation of the Mahabharata

23.4 Themes

23.4.1 Just war

The *Mahābhārata* offers one of the first instances of theorizing about *dharmayuddha*, "just war", illustrating many of the standards that would be debated later across the world. In the story, one of five brothers asks if the suffering caused by war can ever be justified. A long discussion ensues between the siblings, establishing criteria like *proportionality* (chariots cannot attack cavalry, only other chariots; no attacking people in distress), *just means* (no poisoned or barbed arrows), *just cause* (no attacking out of rage), and fair treatment of captives and the wounded.* [46]

23.5 Versions, translations, and derivative works

23.5.1 Critical Edition

Between 1919 and 1966, scholars at the Bhandarkar Oriental Research Institute, Pune, compared the various manuscripts of the epic from India and abroad and produced the *Critical Edition* of the *Mahabharata*, on 13,000 pages in 19 volumes, followed by the *Harivamsha* in another two volumes and six index volumes. This is the text that is usually used in current Mahābhārata studies for reference.* [47] This work is sometimes called the "Pune" or "Poona" edition of the *Mahabharata*.

23.5.2 Regional versions

Many regional versions of the work developed over time, mostly differing only in minor details, or with verses or subsidiary stories being added. These include the Tamil street theatre, *terukkuttu* and *kattaikkuttu*, the plays of which use themes from the Tamil language versions of *Mahabharata*, focusing on Draupadi.* [48]



The Pandavas and Krishna in an act of the Javanese wayang wong performance

Outside the Indian subcontinent, in Indonesia, a version was developed in ancient Java as *Kakawin Bhāratayuddha* in the 11th century under the patronage of King Dharmawangsa (990–1016)* [49] and later it spread to the neighboring island of Bali, which remains a Hindu majority island today. It has become the fertile source for Javanese literature, dance drama (*wayang wong*), and *wayang* shadow puppet performances. This Javanese version of the *Mahābhārata* differs slightly from the original Indian version. For example, *Draupadi* is only wed to *Yudhishtira*, not to all the Pandava brothers; this might demonstrate ancient Javanese opposition to polyandry. The author later added some female characters to be wed to the Pandavas, for example, *Arjuna* is described as having many wives and consorts next to *Subhadra*. Another difference is that *Shikhandini* does not change her sex and remains a woman, to be wed to *Arjuna*, and takes the role of a warrior princess during the war. Another twist is that *Gandhari* is described as

antagonistic character who hates the Pandavas: her hate is out of jealousy because during Gandhari's *swayamvara*, she was in love with Pandu but was later wed to his blind elder brother instead, whom she did not love, so she blindfolded herself as protest. Another notable difference is the inclusion of the *Punakawans*, the clown servants of the main characters in the storyline. These characters include *Semar*, *Petruk*, *Gareng* and *Bagong*, who are much-loved by Indonesian audiences. There are also some spin-off episodes developed in ancient Java, such as *Arjunawiwaha* composed in 11th century.

A *Kawi* version of the *Mahabharata*, of which eight of the eighteen *parvas* survive, is found on the Indonesian island of *Bali*. It has been translated into English by Dr. I. Gusti Putu Phalgunadi.

23.5.3 Translations

A *Persian* translation of *Mahabharata*, titled *Razmnameh*, was produced at Akbar's orders, by *Faizi* and 'Abd al-Qadir Bada'uni in the 18th century.*[51]

The first complete English translation was the *Victorian* prose version by *Kisari Mohan Ganguli*,*[52] published between 1883 and 1896 (Munshiram Manoharlal Publishers) and by M. N. Dutt (Motilal Banarsidass Publishers). Most critics consider the translation by Ganguli to be faithful to the original text. The complete text of Ganguli's translation is in the *public domain* and is available online.*[53]*[54]

Another English prose translation of the full epic, based on the *Critical Edition*, is in progress, published by *University Of Chicago Press*. It was initiated by *Indologist J. A. B. van Buitenen* (books 1–5) and, following a 20-year hiatus caused by the death of van Buitenen, is being continued by D. Gitomer of *DePaul University* (book 6), J. L. Fitzgerald of *Brown University* (books 11–13) and *Wendy Doniger* of the *University of Chicago* (books 14–18).

An early poetry translation by *Romesh Chunder Dutt* and published in 1898 condenses the main themes of the *Mahābhārata* into English verse.*[55] A later poetic “transcreation” (author's own description) of the full epic into English, done by the poet *P. Lal*, is complete, and in 2005 began being published by *Writers Workshop*, Calcutta. The *P. Lal* translation is a non-rhyming verse-by-verse rendering, and is the only edition in any language to include all *slokas* in all recensions of the work (not just those in the *Critical Edition*). The completion of the publishing project is scheduled for 2010. Sixteen of the eighteen volumes are now available.

A project to translate the full epic into English prose, translated by various hands, began to appear in 2005 from the *Clay Sanskrit Library*, published by *New York University Press*. The translation is based not on the *Critical Edition* but on the version known to the commentator *Nilakaṇṭha*. Currently available are 15 volumes of the projected 32-volume edition.

Indian economist *Bibek Debroy* has also begun an unabridged English translation in ten volumes. *Volume 1: Adi Parva* was published in March 2010.

Many condensed versions, abridgements and novelistic prose retellings of the complete epic have been published in English, including works by *Ramesh Menon*, *William Buck*, *R. K. Narayan*, *C. Rajagopalachari*, *K. M. Munshi*, *Krishna Dharma*, *Romesh C. Dutt*, *Bharadvaja Sarma*, *John D. Smith* and *Sharon Maas*.

23.5.4 Derivative literature

Bhasa, the 2nd- or 3rd-century CE Sanskrit playwright, wrote two plays on episodes in the *Mahabharata*, *Urubhanga* (Broken Thigh), about the fight between *Duryodhana* and *Bhima*, while *Madhyamavyayoga* (The Middle One) set around *Bhima* and his son, *Ghatotkacha*. The first important play of 20th century was *Andha Yug* (The Blind Epoch), by *Dharamvir Bharati*, which came in 1955, found in *Mahabharat*, both an ideal source and expression of modern predicaments and discontent. Starting with *Ebrahim Alkazi* it was staged by numerous directors. *V. S. Khandekar's* Marathi novel, *Yayati* (1960) and *Girish Karnad's* debut play *Yayati* (1961) are based on the story of King *Yayati* found in the *Mahabharat*.*[56] Bengali writer and playwright, *Buddhadeva Bose* wrote three plays set in *Mahabharat*, *Anamni Angana*, *Pratham Partha* and *Kalsandhya*.*[57] *Pratibha Ray* wrote an award winning novel entitled *Yajnaseni* from *Draupadi's* perspective in 1984. Later, *Chitra Banerjee Divakaruni* wrote a similar novel entitled *The Palace of Illusions: A Novel* in 2008. Gujarati poet *Chinu Modi* has written long narrative poetry *Bahuk* based on character *Bahuka*.*[58] *Krishna Udayasankar*, a Singapore-based Indian author has written several novels which are modern-day retellings of the epic, most notably the *Aryavarta Chronicles Series*. *Suman Pokhrel* wrote a solo play based on *Ray's* novel by personalizing and taking *Draupadi* alone in the scene.

Amar Chitra Katha published a 1,260 page comic book version of the *Mahabharata*.*[59]

23.5.5 In film and television

In Indian cinema, several film versions of the epic have been made, dating back to 1920. * [60] In Telugu film *Daana Veera Soora Karna* (1977) directed by and starring N. T. Rama Rao depicts Karna as the lead character. * [61] The Mahābhārata was also reinterpreted by Shyam Benegal in Kalyug. * [62] Prakash Jha directed 2010 film *Raajneeti* was partially inspired by the *Mahabharata*. * [63] A 2013 animated adaptation holds the record for India's most expensive animated film. * [64]

In the late 1980s, the *Mahabharat TV series*, directed by Ravi Chopra, * [65] was televised on India's national television (Doordarshan). The same year as *Mahabharat* was being shown on Doordarshan, that same company's other television show, *Bharat Ek Khoj*, also directed by Shyam Benegal, showed a 2-episode abbreviation of the *Mahabharata*, drawing from various interpretations of the work, be they sung, danced, or staged. In the Western world, a well-known presentation of the epic is Peter Brook's nine-hour play, which premiered in Avignon in 1985, and its five-hour movie version *The Mahābhārata* (1989). * [66]

Uncompleted projects on the Mahābhārata include a ones by Rajkumar Santoshi, * [67] and a theatrical adaptation planned by Satyajit Ray. * [68]

23.6 Jain version

Further information: *Salakapurusa*

Jain versions of Mahābhārata can be found in the various Jain texts like *Harivamsapurana* (the story of Harivamsa) *Trisastisalakapurusa Caritra* (Hagiography of 63 Illustrious persons), *Pandavacaritra* (lives of Pandavas) and *Pandavapurana* (stories of Pandavas). * [69] From the earlier canonical literature, *Antakrddaaśāh* (8th cannon) and *Vrisnidasa (up-angagama* or secondary canon) contain the stories of Neminatha (22nd Tirthankara), Krishna and Balarama. * [70] Prof. Padmanabh Jaini notes that, unlike in the Hindu Puranas, the names Baladeva and Vasudeva are not restricted to Balarama and Krishna in Jain puranas. Instead they serve as names of two distinct class of mighty brothers, who appear nine times in each half of time cycles of the Jain cosmology and rule the half the earth as half-chakravartins. Jaini traces the origin of this list of brothers to the Jinacharitra by Bhadrabahu swami (4th–3rd century BCE). * [71] According to Jain cosmology Balarama, Krishna and Jarasandha are the ninth and the last set of Baladeva, Vasudeva, and Partivasudeva. * [72] The main battle is not the Mahabharata, but the fight between Krishna and Jarasandha (who is killed by Krishna). Ultimately, the Pandavas and Balarama take renunciation as Jain monks and are reborn in heavens, while on the other hand Krishna and Jarasandha are reborn in hell. * [73] In keeping with the law of karma, Krishna is reborn in hell for his exploits (sexual and violent) while Jarasandha for his evil ways. Prof. Jaini admits a possibility that perhaps because of his popularity, the Jain authors were keen to rehabilitate Krishna. The Jain texts predict that after his karmic term in hell is over sometime during the next half time-cycle, Krishna will be reborn as a Jain Tirthankara and attain liberation. * [72] Krishna and Balrama are shown as contemporaries and cousins of 22nd Tirthankara, Neminatha. * [74] According to this story, Krishna arranged young Neminath's marriage with Rajamati, the daughter of Ugrasena, but Neminatha, empathizing with the animals which were to be slaughtered for the marriage feast, left the procession suddenly and renounced the world. * [75] * [76]

23.7 Kuru family tree

This shows the line of royal and family succession, not necessarily the parentage. See the notes below for detail.

Key to Symbols

- Male: *blue border*
- Female: *red border*
- Pandavas: *green box*
- Kauravas: *yellow box*

Notes

- **a:** **Shantanu** was a king of the Kuru dynasty or kingdom, and was some generations removed from any ancestor called **Kuru**. His marriage to **Ganga** preceded his marriage to **Satyavati**.
- **b:** **Pandu** and **Dhritarashtra** were fathered by **Vyasa** in the *niyoga* tradition after **Vichitravirya's** death. **Dhritarashtra**, **Pandu** and **Vidura** were the sons of **Vyasa** with **Ambika**, **Ambalika** and a maid servant respectively.
- **c:** **Karna** was born to **Kunti** through her invocation of **Surya**, before her marriage to **Pandu**.
- **d:** **Yudhishtira**, **Bhima**, **Arjuna**, **Nakula** and **Sahadeva** were acknowledged sons of **Pandu** but were begotten by the invocation by **Kunti** and **Madri** of various deities. They all married **Draupadi** (not shown in tree).
- **e:** **Duryodhana** and his siblings were born at the same time, and they were of the same generation as their **Pandava** cousins.
- **f :** Although the succession after the Pandavas was through the descendants of **Arjuna** and **Subhadra**, it was **Yudhishtira** and **Draupadi** who occupied the throne of **Hastinapura** after the great battle.

The birth order of siblings is correctly shown in the family tree (from left to right), except for **Vyasa** and **Bhishma** whose birth order is not described, and **Vichitravirya** and **Chitrangada** who were born after them. The fact that **Ambika** and **Ambalika** are sisters is not shown in the family tree. The birth of **Duryodhana** took place after the birth of **Karna**, **Yudhishtira** and **Bhima**, but before the birth of the remaining **Pandava** brothers.

Some siblings of the characters shown here have been left out for clarity; these include **Chitrāngada**, the eldest brother of **Vichitravirya**. **Vidura**, half-brother to **Dhritarashtra** and **Pandu**.

23.8 Cultural influence

In the *Bhagavad Gita*, **Krishna** explains to **Arjuna** his duties as a warrior and prince and elaborates on different *Yogic**[77] and *Vedantic* philosophies, with examples and analogies. This has led to the *Gita* often being described as a concise guide to *Hindu* philosophy and a practical, self-contained guide to life.*[78] In more modern times, **Swami Vivekananda**, **Bal Gangadhar Tilak**, **Mahatma Gandhi** and many others used the text to help inspire the *Indian independence movement*.*[79]*[80]

Various modern day Television shows and novels have taken inspiration from the *Mahabharata*

23.9 Editions

- *The Mahabharata: Complete and Unabridged* (set of 10 volumes) by **Bibek Debroy**, Penguin Books India.
- *The Mahābhārata of Vyasa* (18 volumes), transcreated from Sanskrit by **P. Lal**, Writers Workshop.

23.10 References

- [1] **Datta, Amaresh** (1 January 2006). "The Encyclopaedia of Indian Literature (Volume Two) (Devraj to Jyoti)". ISBN 978-81-260-1194-0.
- [2] **Brockington** (1998, p. 26)
- [3] **Van Buitenen**; *The Mahabharata* – 1; The Book of the Beginning. Introduction (Authorship and Date)
- [4] *bhārata* means the progeny of *Bharata*, the legendary king who is claimed to have founded the *Bhāratavarsha* kingdom.
- [5] **James G. Lochtefeld** (2002). *The Illustrated Encyclopedia of Hinduism: A-M*. The Rosen Publishing Group. p. 399. ISBN 978-0-8239-3179-8.
- [6] **T. R. S. Sharma**; **June Gaur**; **Sahitya Akademi** (New Delhi, Inde). (2000). *Ancient Indian Literature: An Anthology*. Sahitya Akademi. p. 137. ISBN 978-81-260-0794-3.
- [7] **Spodek, Howard**. **Richard Mason**. The World's History. Pearson Education: 2006, New Jersey. 224, 0-13-177318-6

- [8] Amartya Sen, *The Argumentative Indian. Writings on Indian Culture, History and Identity*, London: Penguin Books, 2005.
- [9] W. J. Johnson (1998). *The Sauptikaparvan of the Mahabharata: The Massacre at Night*. Oxford University Press. p. ix. ISBN 978-0-19-282361-8.
- [10] Davis, Richard H. (2014). *The "Bhagavad Gita": A Biography*. Princeton University Press. p. 38. ISBN 9781400851973. Retrieved 31 May 2017.
- [11] Krishnan, Bal (1978). *Kurukshetra: Political and Cultural History*. B.R. Publishing Corporation. p. 50. Retrieved 31 May 2017.
- [12] Hermann Oldenberg, *Das Mahabharata: seine Entstehung, sein Inhalt, seine Form*, Göttingen, 1922,
- [13] "The Mahabharata" at *The Sampradaya Sun*
- [14] *A History of Indian Literature*, Volume 1 by Maurice Winternitz
- [15] Buitenen (1973) pp. xxiv–xxv
- [16] "The Mahabharata: How an oral narrative of the bards became a text of the Brahmins" .
- [17] Sukthankar (1933) "Prolegomena" p. lxxxvi. Emphasis is original.
- [18] Gupta & Ramachandran (1976), citing *Mahabharata*, Critical Edition, I, 56, 33
- [19] SP Gupta and KS Ramachandran (1976), p.3-4, citing Vaidya (1967), p.11
- [20] Brockington, J. L. (1998). *The Sanskrit epics, Part 2*. Volume 12. BRILL. p. 21. ISBN 90-04-10260-4.
- [21] 18 books, 18 chapters of the *Bhagavadgita* and the *Narayaniya* each, corresponding to the 18 days of the battle and the 18 armies (Mbh. 5.152.23)
- [22] The Spitzer Manuscript (Beitrage zur Kultur- und Geistesgeschichte Asiens), Austrian Academy of Sciences, 2004. It is one of the oldest Sanskrit manuscripts found on the Silk Road and part of the estate of Dr. Moritz Spitzer.
- [23] The Oldest Extant Parvan-List of the *Mahābhārata*, Dieter Schlingloff, *Journal of the American Oriental Society*, Vol. 89, No. 2, April–June 1969, pp. 334–338, at JSTOR
- [24] J.A.B. van Buitenen, *Mahābhārata, Volume 1*, p.445, citing W. Caland, *The Pañcaviṃśa Brāhmaṇa*, p.640-2
- [25] Dio Chrysostom, 53.6–7, trans. H. Lamar Crosby, Loeb Classical Library, 1946, vol. 4, p. 363.
- [26] Christian Lassen, in his *Indische Alterthumskunde*, supposed that the reference is ultimately to Dhritarashtra's sorrows, the laments of Gandhari and Draupadi, and the valor of Arjuna and Suyodhana or Karna (cited approvingly in Max Duncker, *The History of Antiquity* (trans. Evelyn Abbott, London 1880), vol. 4, p. 81). This interpretation is endorsed in such standard references as Albrecht Weber's *History of Indian Literature* but has sometimes been repeated as fact instead of as interpretation.
- [27] "The Mahabharata, Book 6: Bhishma Parva: Bhagavat-Gita Parva: Section XXV (*Bhagavad Gita* Chapter I)". Sacred-texts.com. Retrieved 3 August 2012.
- [28] "The Mahabharata, Book 6: Bhishma Parva: Bhagavat-Gita Parva: Section XLII (*Bhagavad Gita*, Chapter XVIII)". Sacred-texts.com. Retrieved 3 August 2012.
- [29] The *Ashvamedhika-parva* is also preserved in a separate version, the *Jaimini-Bharata* (*Jaiminiya-ashvamedha*) where the frame dialogue is replaced, the narration being attributed to Jaimini, another disciple of Vyasa. This version contains far more devotional material (related to Krishna) than the standard epic and probably dates to the 12th century. It has some regional versions, the most popular being the Kannada one by Devapurada Annama Lakshmisha (16th century).The Mahabharata
- [30] In discussing the dating question, historian A. L. Basham says: "According to the most popular later tradition the Mahabharata War took place in 3102 BCE, which in the light of all evidence, is quite impossible. More reasonable is another tradition, placing it in the 15th century BCE, but this is also several centuries too early in the light of our archaeological knowledge. Probably the war took place around the beginning of the 9th century BCE; such a date seems to fit well with the scanty archaeological remains of the period, and there is some evidence in the Brahmana literature itself to show that it cannot have been much earlier." Basham, p. 40, citing HC Raychaudhuri, *Political History of Ancient India*, pp.27ff.
- [31] M Witzel, *Early Sanskritization: Origin and Development of the Kuru state*, EJVS vol.1 no.4 (1995); also in B. Kölver (ed.), *Recht, Staat und Verwaltung im klassischen Indien. The state, the Law, and Administration in Classical India*, München, R. Oldenbourg, 1997, p.27-52

- [32] A.D. Pusalker, *History and Culture of the Indian People*, Vol I, Chapter XIV, p.273
- [33] FE Pargiter, *Ancient Indian Historical Tradition*, p.180. He shows estimates of the average as 47, 50, 31 and 35 for various versions of the lists.
- [34] Pargiter, *op.cit.* p.180-182
- [35] B. B. Lal, *Mahabharata and Archaeology* in Gupta and Ramachandran (1976), p.57-58
- [36] Keay, John (2000). *India: A History*. New York City: Grove Press. p. 42. ISBN 0-8021-3797-0.
- [37] Gupta and Ramachandran (1976), p.246, who summarize as follows: “Astronomical calculations favor 15th century BCE as the date of the war while the Puranic data place it in the 10th/9th century BCE. Archaeological evidence points towards the latter.” (p.254)
- [38] “Lord Krishna lived for 125 years” .
- [39] “5151 years of Gita” .
- [40] Gupta and Ramachandran (1976), p.55; AD Pusalker, HCIP, Vol I, p.272
- [41] AD Pusalker, *op.cit.* p.272
- [42] “Sanskrit, Tamil and Pahlavi Dictionaries” (in German). Webapps.uni-koeln.de. 11 February 2003. Retrieved 1 September 2010.
- [43] “Book 1: Adi Parva: Jatugriha Parva” . Sacred-texts.com. Retrieved 1 September 2010.
- [44] “Book 2: Sabha Parva: Sabhakriya Parva” . Sacred-texts.com. Retrieved 1 September 2010.
- [45] Rajagopalachari, Chakravarti (2005). “Yudhishtira's final trial” . *Mahabharata* (45th ed.). Mumbai: Bharatiya Vidya Bhavan. ISBN 81-7276-368-9.
- [46] Robinson, P.F. (2003). *Just War in Comparative Perspective*. Ashgate. p. 117. ISBN 9780754635871. Retrieved 2 October 2015.
- [47] Bhandarkar Institute, Pune—Virtual Pune
- [48] Srinivas, Smriti (2004) [2001]. *Landscapes of Urban Memory*. Orient Longman. p. 23. ISBN 81-250-2254-6. OCLC 46353272.
- [49] “The Javanization of the Mahābhārata, Chapter 15. Indic Transformation: The Sanskritization of Jawa and the Javanization of the Bharata” .
- [50] “picture details” . Plant Cultures. Retrieved 1 September 2010.
- [51] Gaṅgā Rām, Garg (1992). *Encyclopaedia of the Hindu world, Volume 1*. p. 129. ISBN 978-81-7022-376-4.
- [52] Several editions of the Kisari Mohan Ganguli translation of the *Mahabharata* incorrectly cite the publisher, Pratap Chandra Roy, as the translator and this error has been propagated into secondary citations. See the publishers preface to the current Munshiram Manoharlal edition for an explanation.
- [53] The Mahabharata of Krishna-Dwaipayana Vyasa translated by Kisari Mohan Ganguli at the Internet Sacred Text Archive
- [54] P. Lal. “Kisari Mohan Ganguli and Pratap Chandra Roy” . *An Annotated Mahabharata Bibliography*. Calcutta: Writers Workshop.
- [55] The *Mahabharata* of Krishna-Dwaipayana Vyasa translated by Romesh Chunder Dutt at the Online Library of Liberty.
- [56] Don Rubin (1998). *The World Encyclopedia of Contemporary Theatre: Asia*. Taylor & Francis. p. 195. ISBN 0-415-05933-X.
- [57] The Mahabharata as Theatre by Pradip Bhattacharya, June 13, 2004.
- [58] Topiwala, Chandrakant (1990). “Bahuk” . *Gujarati Sahityakosh (Encyclopedia of Gujarati Literature)* (in Gujarati). 2. Ahmedabad: Gujarati Sahitya Parishad. p. 394.
- [59] Pai, Anant (1998). Pai, Anant, ed. *Amar Chitra Katha Mahabharata*. Kadam, Dilip (illus.). Mumbai: Amar Chitra Katha. p. 1200. ISBN 81-905990-4-6.
- [60] *Mahabharat* on Internet Movie Database (1920 film)

- [61] *Daana Veera Shura Karna* on Internet Movie Database
- [62] “What makes Shyam special” . Hinduonnet.com. 17 January 2003. Retrieved 1 September 2010.
- [63] Kumar, Anuj (27 May 2010). “Fact of the matter” . The Hindu.
- [64] “Mahabharat: Theatrical Trailer (Animated Film)”.
- [65] *Mahabharat* on Internet Movie Database (1988–1990 TV series)
- [66] *The Mahabharata* on Internet Movie Database (1989 mini-series)
- [67] “In brief: Mahabharat will be most expensive Indian movie ever” .
- [68] C. J. Wallia (1996). “IndiaStar book review: Satyajit Ray by Surabhi Banerjee” . Archived from the original on 14 May 2008. Retrieved 31 May 2009.
- [69] Jaini, Padmanabh (2000). *Collected Papers on Jaina Studies*. Delhi: Motilal Banarsidass Publ. ISBN 81-208-1691-9. p. 351-52
- [70] Shah, Natubhai (1998). *Jainism: The World of Conquerors*. Volume I and II. Sussex: Sussex Academy Press. ISBN 1-898723-30-3. vol 1 pp. 14–15
- [71] Jaini, Padmanabh (2000). *Collected Papers on Jaina Studies*. Delhi: Motilal Banarsidass Publ. ISBN 81-208-1691-9. p. 377
- [72] Jaini, Padmanabh (1998). *The Jaina Path of Purification*. New Delhi: Motilal Banarsidass. ISBN 81-208-1578-5. p.305
- [73] Jaini, Padmanabh (2000). *Collected Papers on Jaina Studies*. Delhi: Motilal Banarsidass Publ. ISBN 81-208-1691-9. p. 351
- [74] Roy, Ashim Kumar (1984). *A history of the Jainas*. New Delhi: Gitanjali Pub. House. p. 20. ISBN 978-0-8364-1136-2. OCLC 11604851.
- [75] Helen, Johnson (2009) [1931]. Muni Samvegashvijay Maharaj, ed. *Trisastīśālākāpurusacaritra of Hemacandra: The Jain Saga*. Part II. Baroda: Oriental Institute. ISBN 978-81-908157-0-3. refer story of Neminatha
- [76] Devdutt Pattanaik (2 March 2017). “How different are the Jain Ramayana and Jain Mahabharata from Hindu narrations?”. *Devdutt*. Retrieved 22 March 2017.
- [77] “Introduction to the Bhagavad Gita” . Yoga.about.com. Retrieved 1 September 2010.
- [78] Maharishi Mahesh Yogi; On The Bhagavad Gita; A New Translation and Commentary With Sanskrit Text Chapters 1 to 6, Preface p.9
- [79] Stevenson, Robert W., “Tilak and the Bhagavadgita's Doctrine of Karmayoga” , in: Minor, p. 44.
- [80] Jordens, J. T. F., “Gandhi and the Bhagavadgita” , in: Minor, p. 88.

23.11 Sources

- Badrinath, Chaturvedi. *The Mahābhārata : An Inquiry in the Human Condition*, New Delhi, Orient Longman (2006)
- Bandyopadhyaya, Jayantanuja (2008). *Class and Religion in Ancient India*. Anthem Press.
- Basham, A. L. (1954). *The Wonder That Was India: A Survey of the Culture of the Indian Sub-Continent Before The Coming of the Muslims*. New York: Grove Press.
- Bhasin, R.V. “*Mahabharata*” published by National Publications, India, 2007.
- J. Brockington. *The Sanskrit Epics*, Leiden (1998).
- Buitenen, Johannes Adrianus Bernardus (1978). *The Mahābhārata*. 3 volumes (translation / publication incomplete due to his death). University of Chicago Press.
- Chaitanya, Krishna (K.K. Nair). *The Mahabharata, A Literary Study*, Clarion Books, New Delhi 1985.

- Gupta, S.P. and Ramachandran, K.S. (ed.). *Mahabharata: myth and reality*. Agam Prakashan, New Delhi 1976.
- Hiltebeitel, Alf. *The Ritual of Battle, Krishna in the Mahabharata*, SUNY Press, New York 1990.
- Hopkins, E. W. *The Great Epic of India*, New York (1901).
- Jyotirmayananda, Swami. *Mysticism of the Mahabharata*, Yoga Research Foundation, Miami 1993.
- Katz, Ruth Cecily *Arjuna in the Mahabharata*, University of South Carolina Press, Columbia 1989.
- Keay, John (2000). *India: A History*. Grove Press. ISBN 0-8021-3797-0.
- Majumdar, R. C. (general editor) (1951). *The History and Culture of the Indian People: (Volume I) The Vedic Age*. London: George Allen & Unwin Ltd.
- Lerner, Paule. *Astrological Key in Mahabharata*, David White (trans.) Motilal Banarsidass, New Delhi 1988.
- Mallory, J. P (2005). *In Search of the Indo-Europeans*. Thames & Hudson. ISBN 0-500-27616-1
- Mehta, M. *The problem of the double introduction to the Mahabharata*, JAOS 93 (1973), 547–550.
- Minkowski, C.Z. *Janamehayas Sattrā and Ritual Structure*, JAOS 109 (1989), 410–420.
- Minkowski, C.Z. 'Snakes, Sattras and the Mahabharata', in: *Essays on the Mahabharata*, ed. A. Sharma, Leiden (1991), 384–400.
- Oldenberg, Hermann. *Zur Geschichte der Altindischen Prosa*, Berlin (1917)
- Oberlies, Th. 'The Counsels of the Seer Narada: Ritual on and under the Surface of the Mahabharata', in: *New methods in the research of epic* (ed. H. L. C. Tristram), Freiburg (1998).
- Oldenberg, H. *Das Mahabharata*, Göttingen (1922).
- Pāṇini. *Ashtādhyāyī*. Book 4. Translated by Chandra Vasu. Benares, 1896. (Sanskrit)(English)
- Pargiter, F.E. *Ancient Indian Historical Tradition*, London 1922. Repr. Motilal Banarsidass 1997.
- Sattar, Arshia (transl.) (1996). *The Rāmāyaṇa by Vālmiki*. Viking. p. 696. ISBN 978-0-14-029866-6.
- Sukthankar, Vishnu S. and Shrimant Balasaheb Pant Pratinidhi (1933). *The Mahabharata: for the first time critically edited*. Bhandarkar Oriental Research Institute.
- Sullivan, Bruce M. *Seer of the Fifth Veda, Kṛṣṇa Dvaipayana Vyasa in the Mahabharata*, Motilal Banarsidass, New Delhi 1999.
- Sutton, Nicholas. *Religious Doctrines in the Mahabharata*, Motilal Banarsidass, New Delhi 2000.
- Utgikar, N. B. *The mention of the Mahābhārata in the Ashvalayana Grhya Sutra*, Proceedings and Transactions of the All-India Oriental Conference, Poona (1919), vol. 2, Poona (1922), 46–61.
- Vaidya, R.V. *A Study of Mahabharat; A Research*, Poona, A.V.G. Prakashan, 1967
- Witzel, Michael, *Epics, Khilas and Puranas: Continuities and Ruptures*, Proceedings of the Third Dubrovnik International Conference on the Sanskrit Epics and Puranas, ed. P. Koskiallio, Zagreb (2005), 21–80.

23.12 External links

- Mahābhārata online
- All volumes in 12 PDF-files (Holybooks.com, 181 MB in total)
- Reading Suggestions, J. L. Fitzgerald, Das Professor of Sanskrit, Department of Classics, Brown University



*Bhishma on his death-bed of arrows with the Pandavas and Krishna. Folio from the Razmnama (1761–1763), Persian translation of the Mahabharata, commissioned by Mughal emperor Akbar. The Pandavas are dressed in Persian armour and robes. * [50]*



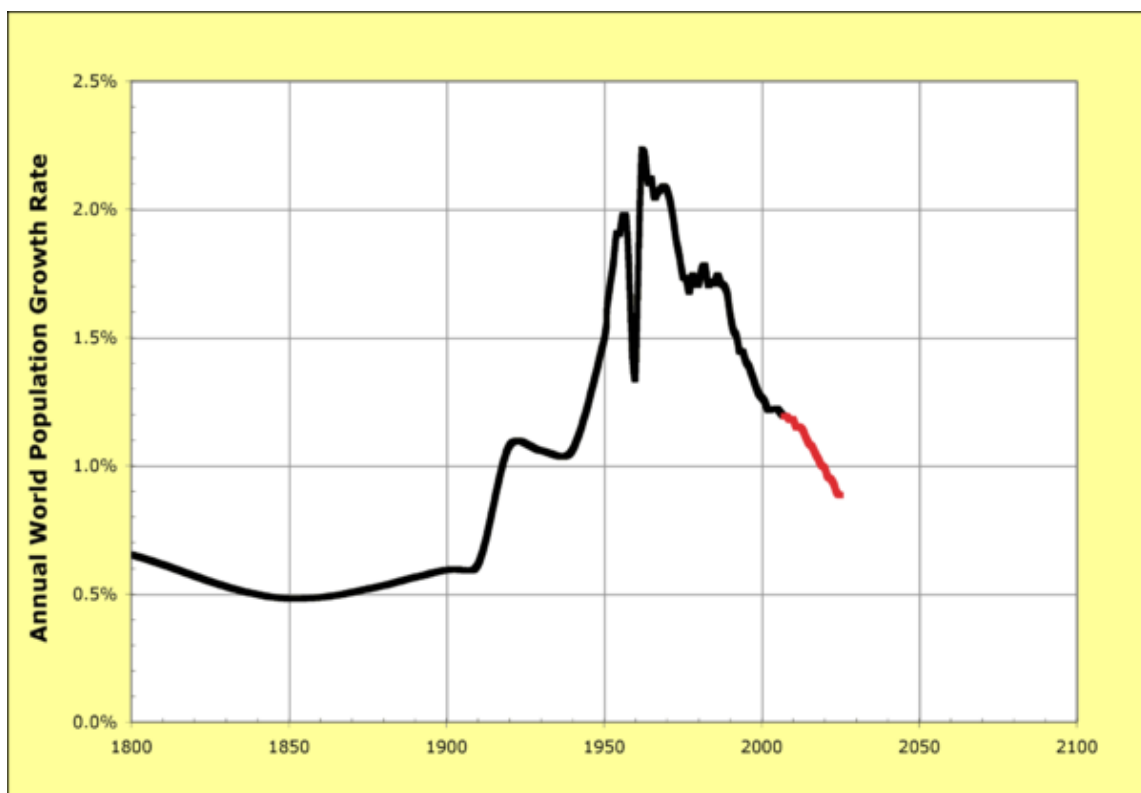
Krishna as portrayed in Yakshagana from Karnataka which is based largely on stories of Mahabharata



Depiction of wedding procession of Lord Neminatha. The enclosure shows the animals that are to be slaughtered for food for weddings. Overcome with Compassion for animals, Neminatha refused to marry and renounced his kingdom to become a Shramana

Chapter 24

Malthusian catastrophe



A chart of estimated annual growth rates in world population, 1800–2005. Rates before 1950 are annualized historical estimates from the *US Census Bureau*. Red = *USCB* projections to 2025.

A **Malthusian catastrophe** (also known as **Malthusian check** or **Malthusian spectre**) is a prediction of a forced return to subsistence-level conditions once population growth has outpaced agricultural production.

24.1 Thomas Malthus

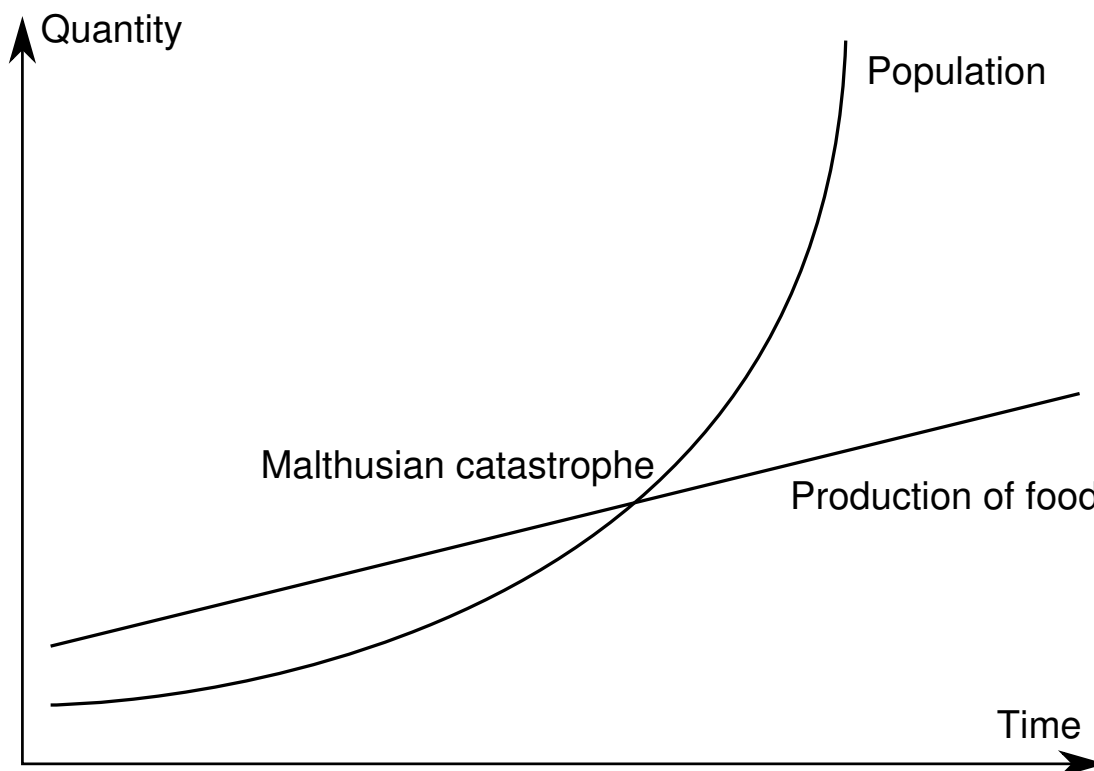
In 1779, Thomas Malthus wrote:

Famine seems to be the last, the most dreadful resource of nature. The power of population is so superior to the power of the earth to produce subsistence for man, that premature death must in some shape or other visit the human race. The vices of mankind are active and able ministers of depopulation. They are the precursors in the great army of destruction, and often finish the dreadful work themselves. But should they fail in this war of extermination, sickly seasons, epidemics, pestilence, and plague advance

in terrific array, and sweep off their thousands and tens of thousands. Should success be still incomplete, gigantic inevitable famine stalks in the rear, and with one mighty blow levels the population with the food of the world.

—Thomas Malthus, 1798. *An Essay on the Principle of Population*. Chapter VII, p61*[1]

Notwithstanding the apocalyptic image conveyed by this particular paragraph, Malthus himself did not subscribe to the notion that mankind was fated for a “catastrophe” due to population overshooting resources. Rather, he believed that population growth was generally restricted by available resources:



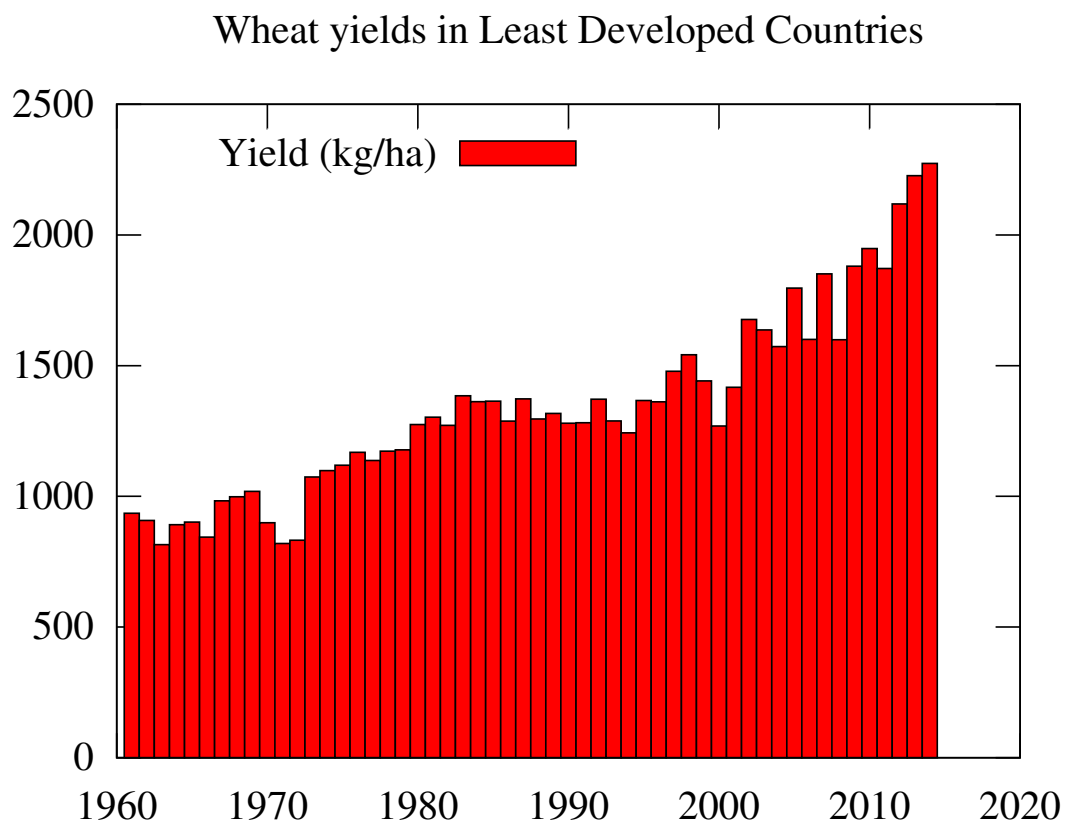
The passion between the sexes has appeared in every age to be so nearly the same that it may always be considered, in algebraic language, as a given quantity. The great law of necessity which prevents population from increasing in any country beyond the food which it can either produce or acquire, is a law so open to our view...that we cannot for a moment doubt it. The different modes which nature takes to prevent or repress a redundant population do not appear, indeed, to us so certain and regular, but though we cannot always predict the mode we may with certainty predict the fact.

—Thomas Malthus, 1798. *An Essay on the Principle of Population*. Chapter IV.

24.2 Neo-Malthusian theory

After World War II, mechanized agriculture produced a dramatic increase in productivity of agriculture and the Green Revolution greatly increased crop yields, expanding the world's food supply while lowering food prices. In response, the growth rate of the world's population accelerated rapidly, resulting in predictions by Paul R. Ehrlich, Simon Hopkins,*[3] and many others of an imminent Malthusian catastrophe. However, populations of most developed countries grew slowly enough to be outpaced by gains in productivity.

By the early 21st century, many technologically developed countries had passed through the demographic transition, a complex social development encompassing a drop in total fertility rates in response to various fertility factors, including lower infant mortality, increased urbanization, and a wider availability of effective birth control.



Wheat yields in developing countries since 1961, in kg/ha. The steep rise in crop yields in the U.S. began in the 1940s. The percentage of growth was fastest in the early rapid growth stage. In developing countries maize yields are still rapidly rising. [2]*

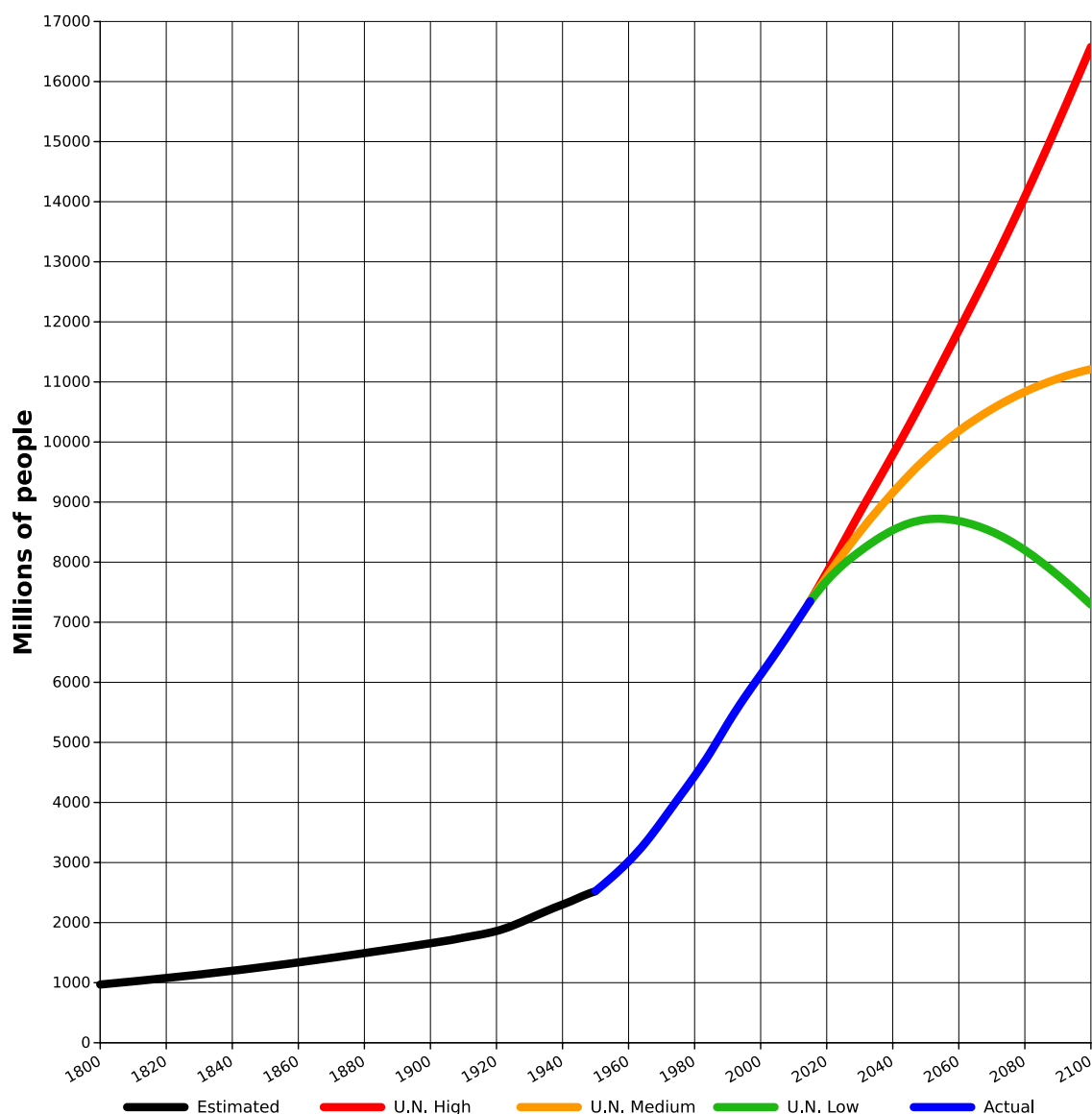
On the assumption that the demographic transition is now spreading from the developed countries to less developed countries, the United Nations Population Fund estimates that human population may peak in the late 21st century rather than continue to grow until it has exhausted available resources.* [4]

Historians have estimated the total human population back to 10,000 BC.* [6] The figure on the right shows the trend of total population from 1800 to 2005, and from there in three projections out to 2100 (low, medium, and high).* [4] The United Nations population projections out to 2100 (the red, orange, and green lines) show a possible peak in the world's population occurring by 2040 in the first scenario, and by 2100 in the second scenario, and never ending growth in the third.

The graph of annual growth rates (at the top of the page) does not appear exactly as one would expect for long-term exponential growth. For exponential growth it should be a straight line at constant height, whereas in fact the graph from 1800 to 2005 is dominated by an enormous hump that began about 1920, peaked in the mid-1960s, and has been steadily eroding away for the last 40 years. The sharp fluctuation between 1959 and 1960 was due to the combined effects of the Great Leap Forward and a natural disaster in China.* [7] Also visible on this graph are the effects of the Great Depression, the two world wars, and possibly also the 1918 flu pandemic.

Though short-term trends, even on the scale of decades or centuries, cannot prove or disprove the existence of mechanisms promoting a Malthusian catastrophe over longer periods, the prosperity of a major fraction of the human population at the beginning of the 21st century, and the debatability of the predictions for ecological collapse made by Paul R. Ehrlich in the 1960s and 1970s, has led some people, such as economist Julian L. Simon, to question its inevitability.* [8]

A 2004 study by a group of prominent economists and ecologists, including Kenneth Arrow and Paul Ehrlich* [9] suggests that the central concerns regarding sustainability have shifted from population growth to the consumption/savings ratio, due to shifts in population growth rates since the 1970s. Empirical estimates show that public policy (taxes or the establishment of more complete property rights) can promote more efficient consumption and investment that are sustainable in an ecological sense; that is, given the current (relatively low) population growth rate,



World population from 1800 to 2100, based on UN 2004 projections (red, orange, green) and US Census Bureau historical estimates (black)

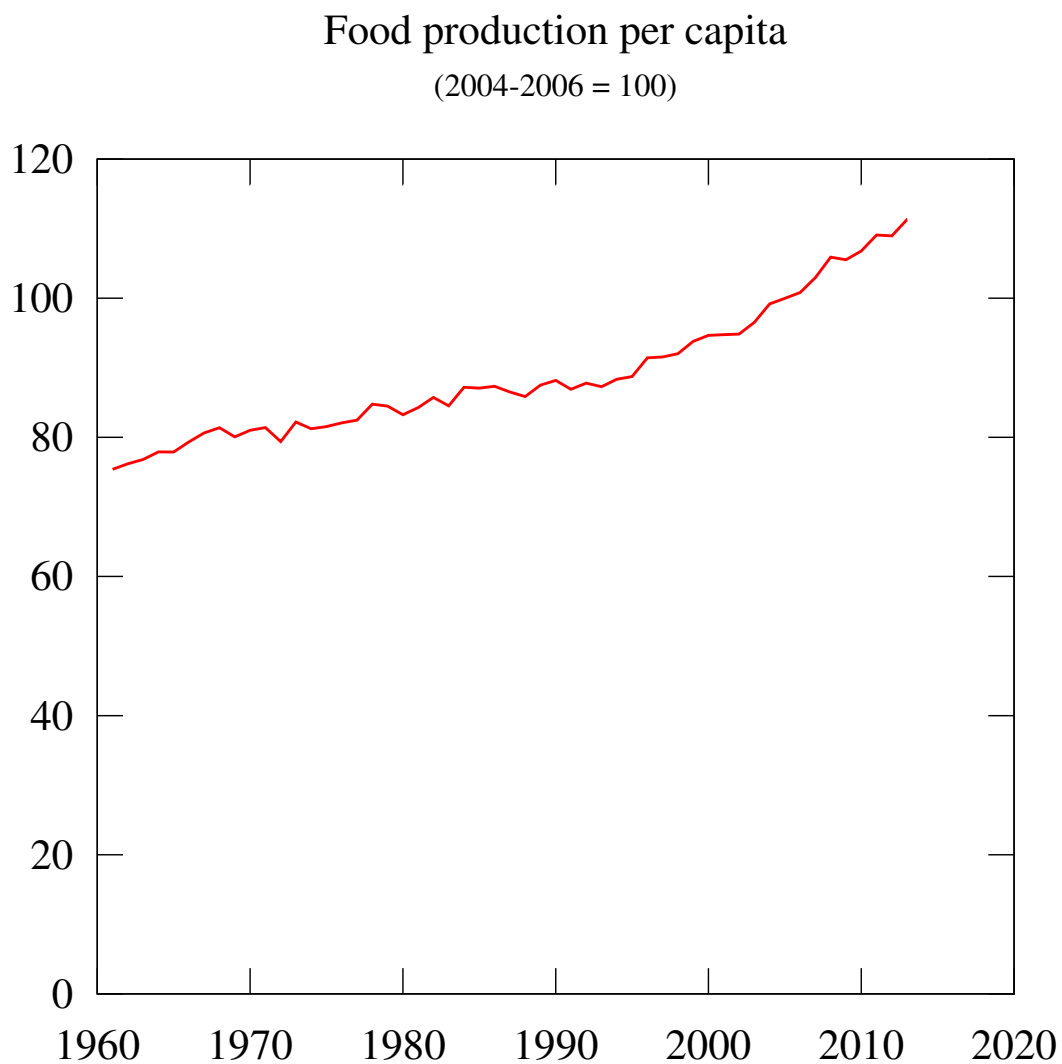
the Malthusian catastrophe can be avoided by either a shift in consumer preferences or public policy that induces a similar shift.

A 2002 study* [10] by the UN Food and Agriculture Organization predicts that world food production will be in excess of the needs of the human population by the year 2030; however, that source also states that hundreds of millions will remain hungry (presumably due to economic realities and political issues).

24.3 Criticism

Since the mid-19th Century, many economists have suggested that humanity will not face a Malthusian catastrophe because “necessity is the mother of invention” and “the market will fix itself” .

Karl Marx and Friedrich Engels argued that Malthus failed to recognize a crucial difference between humans and other species. In capitalist societies, as Engels put it, scientific and technological “progress is as unlimited and at least as rapid as that of population” .*[11] Marx argued, even more broadly, that the growth of both a human population *in toto* and the “relative surplus population” within it, occurred in direct proportion to accumulation.*[12]



Growth in food production has been greater than population growth. Food per person increased since 1961 ^[5]

Henry George criticized Malthus's view that population growth was a cause of poverty, arguing that poverty was caused by the concentration of ownership of land and natural resources. George noted that humans are distinct from other species, because unlike most species humans can use their minds to leverage the reproductive forces of nature to their advantage. He wrote, “Both the jayhawk and the man eat chickens; but the more jayhawks, the fewer chickens, while the more men, the more chickens.” ^[13]

Ester Boserup suggested that population levels determined agricultural methods, rather than agricultural methods determining population. ^[14]

Julian Simon was another economist who argued that there could be no global Malthusian catastrophe, because of two factors: (1) the existence of new knowledge, and educated people to take advantage of it, and (2) “economic freedom”, that is, the ability of the world to increase production when there is a profitable opportunity to do so. ^[15]

In contrast to these criticisms, some individuals, such as **Joseph Tainter**, argue that science has diminishing marginal returns ^[16] and that scientific progress is becoming more difficult, harder to achieve, and more costly.

24.4 See also

- Demographic trap

- The dismal science
- Food security
- Human overpopulation
- Malthusian trap
- Overshoot (population)
- Olduvai theory
- Pledge two or fewer (campaign for smaller families)
- r/K selection theory

24.5 Notes

- [1] Oxford World's Classics reprint
- [2] Fischer, R. A.; Byerlee, Eric; Edmeades, E. O. "Can Technology Deliver on the Yield Challenge to 2050" (PDF). *Expert Meeting on How to Feed the World*. Food and Agriculture Organization of the United Nations: 12.
- [3] Hopkins, Simon (1966). *A Systematic Foray into the Future*. Barker Books. pp. 513–569.
- [4] "2004 UN Population Projections, 2004." (PDF).
- [5] Data source: <http://faostat3.fao.org/download/Q/QI/E>, see graph metadata for further details.
- [6] "Historical Estimates of World Population, U.S. Bureau of the Census, 2006." .
- [7] "International Data Base" .
- [8] Simon, Julian L, "More People, Greater Wealth, More Resources, Healthier Environment", *Economic Affairs: J. Inst. Econ. Affairs*, April 1994.
- [9] Arrow, K., P. Dasgupta, L. Goulder, G. Daily, P. Ehrlich, G. Heal, S. Levin, K. Mäler, S. Schneider, D. Starrett and B. Walker, "Are We Consuming Too Much" *Journal of Economic Perspectives*, 18(3), 147-172, 2004.
- [10] World agriculture 2030: Global food production will exceed population growth August 20, 2002.
- [11] Engels, Friedrich. "Outlines of a Critique of Political Economy" , *Deutsch-Französische Jahrbücher*, 1844, pg.1.
- [12] Karl Marx (transl. Ben Fowkes), *Capital Volume 1*, Harmondsworth, Penguin, 1976 (originally 1867), pp. 782–802.
- [13] Progress and Poverty, Chapter 7, Malthus vs. Facts in <http://www.henrygeorge.org/pchp7.htm>
- [14] Ester Boserup, *The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure*
- [15] The Ultimate Resource II: People, Materials, and Environment in http://www.juliansimon.com/writings/Ultimate_Resource/
- [16] Tainter, Joseph: *The Collapse of Complex Societies*, Cambridge University Press, Cambridge, UK, 2003.

24.6 References

- Korotayev A., Malkov A., Khaltourina D. *Introduction to Social Macrodynamics: Compact Macromodels of the World System Growth*. Moscow: URSS, 2006. ISBN 5-484-00414-4
- Korotayev A., Malkov A., Khaltourina D. *Introduction to Social Macrodynamics: Secular Cycles and Millennial Trends*. Moscow: URSS, 2006. ISBN 5-484-00559-0 See especially Chapter 2 of this book
- Korotayev A. & Khaltourina D. *Introduction to Social Macrodynamics: Secular Cycles and Millennial Trends in Africa*. Moscow: URSS, 2006. ISBN 5-484-00560-4

- Malthus, Thomas Robert (1826). “An Essay on the Principle of Population: A View of its Past and Present Effects on Human Happiness; with an Inquiry into Our Prospects Respecting the Future Removal or Mitigation of the Evils which It Occasions” (Sixth ed.). London: John Murray. Retrieved 2008-11-22.
- Turchin, P., et al., eds. (2007). *History & Mathematics: Historical Dynamics and Development of Complex Societies*. Moscow: KomKniga. ISBN 5-484-01002-0
- A Trap At The Escape From The Trap? Demographic-Structural Factors of Political Instability in Modern Africa and West Asia. *Cliodynamics* 2/2 (2011): 1-28.

24.7 External links

- [Essay on life of Thomas Malthus](#)
- [Malthus' Essay on the Principle of Population](#)
- [David Friedman's essay arguing against Malthus' conclusions](#)
- [United Nations Population Division World Population Trends homepage](#)

Chapter 25

Man bites dog (journalism)

The phrase **man bites dog** is a shortened version of an **aphorism** in **journalism** which describes how an unusual, infrequent event (such as a man biting a dog) is more likely to be reported as news than an ordinary, everyday occurrence with similar consequences, such as a **dog biting a man**. An event is usually considered more newsworthy if there is something unusual about it; a commonplace event is less likely to be seen as newsworthy, even if the consequences of both events have objectively similar outcomes. The result is that rarer events more often appear as news stories, while more common events appear less often, thus distorting the perceptions of news consumers of what constitutes normal rates of occurrence.

The phenomenon is also described in the journalistic saying, “You never read about a plane that did not crash” .*[1]

The phrase was coined by **Alfred Harmsworth** (1865–1922), a British newspaper magnate, but is also attributed to *New York Sun* editor John B. Bogart (1848–1921): “When a dog bites a man, that is not news, because it happens so often. But if a man bites a dog, that is news.” *[2]*[3] The quote is also attributed to **Charles Anderson Dana** (1819–1897).*[4]*[5]

Some consider it a principle of **yellow journalism**.*[6]

25.1 Examples of literal use in journalism

In 2000, the *Santa Cruz Sentinel* ran a story titled “Man bites dog” about a **San Francisco** man who bit his own dog.*[7]

Reuters ran a story, “It's News! Man Bites Dog” , about a man biting a dog*[8] in December 2007.

A 2008 story of a boy biting a dog in Brazil had news outlets quoting the phrase.*[9]

In 2010, NBC Connecticut ran a story about a man who bit a police dog, prefacing it with, “It's often said, if a dog bites a man it's not news, but if a man bites a dog, you've got a story. Well, here is that story.” *[10]

On May 14, 2012, the *Medway Messenger*, a British local newspaper, ran a front page story headlined “MAN BITES DOG” about a man who survived a vicious attack from a Staffordshire bull terrier by biting the dog back.*[11]

On September 27, 2012, the *Toronto Star*, a Canadian newspaper, ran the story headlined “Nearly Naked Man Bites Dog” , about a man that is alleged to have bitten a dog in Pembroke, Ontario.*[12]

On December 2, 2012, *Sydney Morning Herald* reported about a man that bit the dog and its unfortunate consequence; 'Man bites Dog, goes to hospital' *[13]

On May 5, 2013, “Nine News” , an Australian news outlet, ran a story headlined “Man bites dog to save wife” about a man who bit a Labrador on the nose, after it attacked his wife and bit off her nose.*[14]

On March 12, 2014, Rosbalt, a Russian news agency, reported that a man in **Lipetsk** had burnt a bed in his apartment, run around the city in his underwear, and, finally, “bit a fighting breed dog” following an hours-long online debate about the situation in **Ukraine**.*[15]

In April 2014, **CNN** reported a mom bit a pit bull attacking her daughter.*[16]

On June 14, 2014, the *South Wales Argus* ran a front page teaser headlined “Man Bites Dog” about a man who has

been accused of assaulting his partner and her pet dog. The Online version of this story was later amended to “Man bites dog and escapes jail” .*[17]

On September 1, 2014 the *Coventry Telegraph* and the *Daily Mirror* ran an article about a man who had bitten a dog after it attacked his pet.*[18]*[19]

On December 17, 2014 the *Cambridge News* ran an article with a headline starting: “Man bites dog then dies” .*[20]

On November 4, 2015 the *Washington Post* ran an article with the title “Man bites dog. No, really.” *[21]

There have also been a number of “dog shoots man” news stories.*[22]*[23]*[24]*[25]*[26]*[27]*[28]

As an example of a related phrase, a story titled “Deer Shoots Hunter” appeared in a 1947 issue of the *Pittsburgh Press*, mentioning a hunter that was shot by his own gun due to a reflex kick by the deer he had killed.*[29]

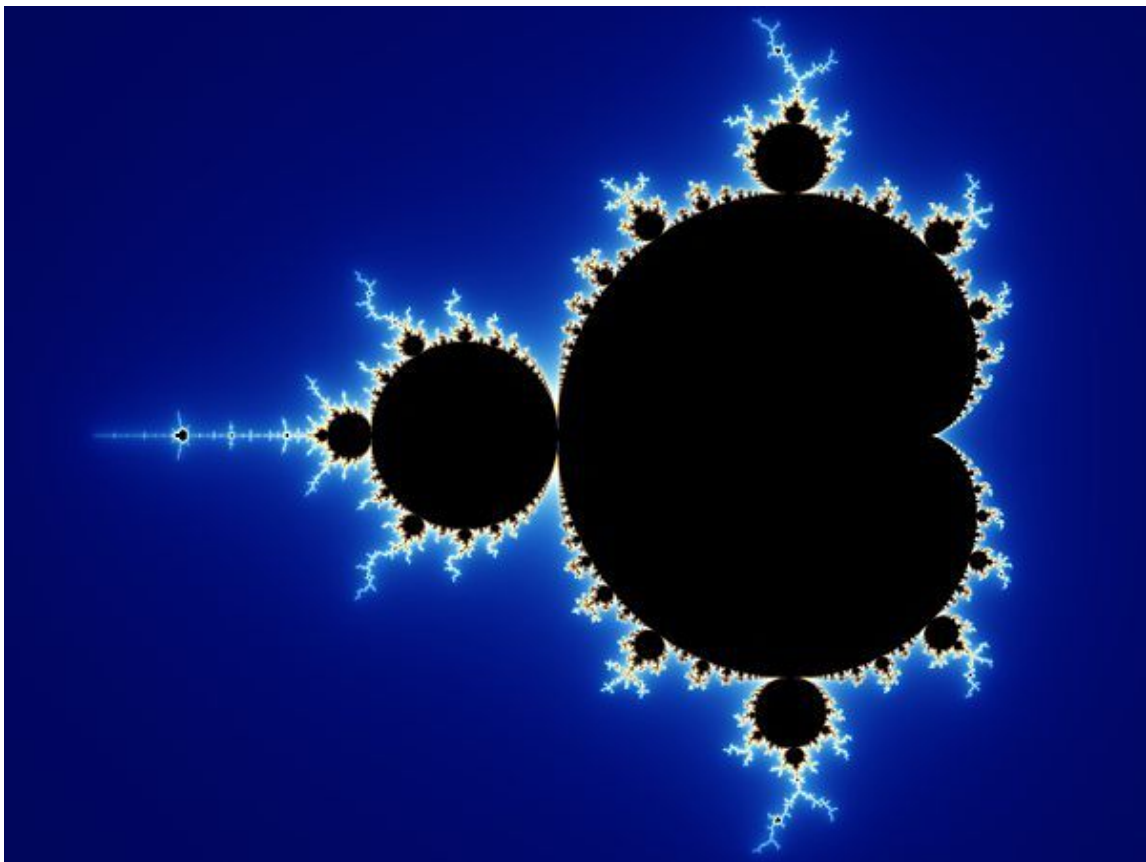
25.2 References

- [1] “There's news in planes that don't crash” . *Pittsburgh Post-Gazette*. September 14, 2006.
- [2] *Bartlett's Familiar Quotations*, 16th edition, ed. Justin Kaplan (Boston, London, and Toronto: Little, Brown, 1992), p. 554.
- [3] Frank Luther Mott (1941) *American Journalism. A History of Newspapers in the United States through 250 Years, 1690 to 1940*
- [4] *Recollections of the Civil War* By Charles Anderson Dana, Charles E. Rankin pp. xvi, xix
- [5] (Russian) Dushenko, K. *Great Dictionary of quotes and flying phrases (Большой словарь цитат и крылатых выражений)*. “Litres” . 2017
- [6] (Russian) Serov, V. *Encyclopedic dictionary of flying words and phrases (Энциклопедический словарь крылатых слов и выражений)*. *Bibliotekar.ru*.
- [7] “State Briefs” column of the Sunday, November 5, 2000 edition, page B-16
- [8] “It's news! Man bites rabid dog in southern India” . *Reuters*. December 14, 2007.
- [9] “Boy Bites Dog In Brazil” . *Citytv*. July 24, 2008.
- [10] “Man Sinks Teeth Into Police Dog” . *NBCUniversal*. October 8, 2010.
- [11] “Teen Joseph Ripley locked up after man bites dog in self-defence” .
- [12] “Nearly naked man bites dog, witnesses say” . *The Star*. Toronto.
- [13] “Man bites dog, goes to hospital” . *The Sydney Morning Herald*.
- [14] <http://news.ninemsn.com.au/world/2013/05/05/08/44/man-bites-dog-to-save-wife>
- [15] “Житель Липецка после споров о событиях на Украине покусал бойцовую собаку”.
- [16] “Mom bites pit bull as it attacks girl - CNN Video” .
- [17] “Man bites dog and escapes jail” .
- [18] Gilbert, Simon (1 September 2014). “People filmed as father and son fought off crazed dog with shears in Coventry street” .
- [19] Aspinall, Adam (1 September 2014). “Man bites dog fending off vicious attack against own pet” .
- [20] “Man bites dog then dies at One-Stop shop in Cambridge” . 17 December 2014.
- [21] “Man bites dog. No, really.” .
- [22] “Dog Shoots Iowa Man During Hunt” , BBC News, October 30, 2007. Retrieved December 19, 2014.
- [23] Hough, Andrew (December 1, 2011). “Dog Shoots Man in Buttocks, U.S. Police Reveal” , *The Telegraph*. Retrieved December 19, 2104.
- [24] Newcomb, Alissa (December 12, 2011). “Sit, Stay, Aim, Fire. Dog Shoots Another Hunter” , ABC News. Retrieved December 19, 2014.

- [25] “No Hard Feelings After Dog Shoots Huntsman in France” , BBC News, September 17, 2012. Retrieved December 19, 2014.
- [26] Meisel, Jay (February 25, 2013). “Dog Shoots Man Accidentally, Police Say” , *Highlands Today*. Retrieved December 19, 2014.
- [27] “Dog Shoots Man: Pet Owner Recovering After Freak Gun Accident” , Fox News, December 19, 2014. Retrieved December 19, 2014.
- [28] Buckley, Madeline (October 27, 2015). “Dog Named Trigger Shoots Indiana Hunter in Foot” , *Indianapolis Star*. Retrieved November 5, 2015.
- [29] “Deer Shoots Hunter” , *Pittsburgh Press*, October 18, 1947, via Google News. Retrieved November 5, 2015.

Chapter 26

Mandelbrot set



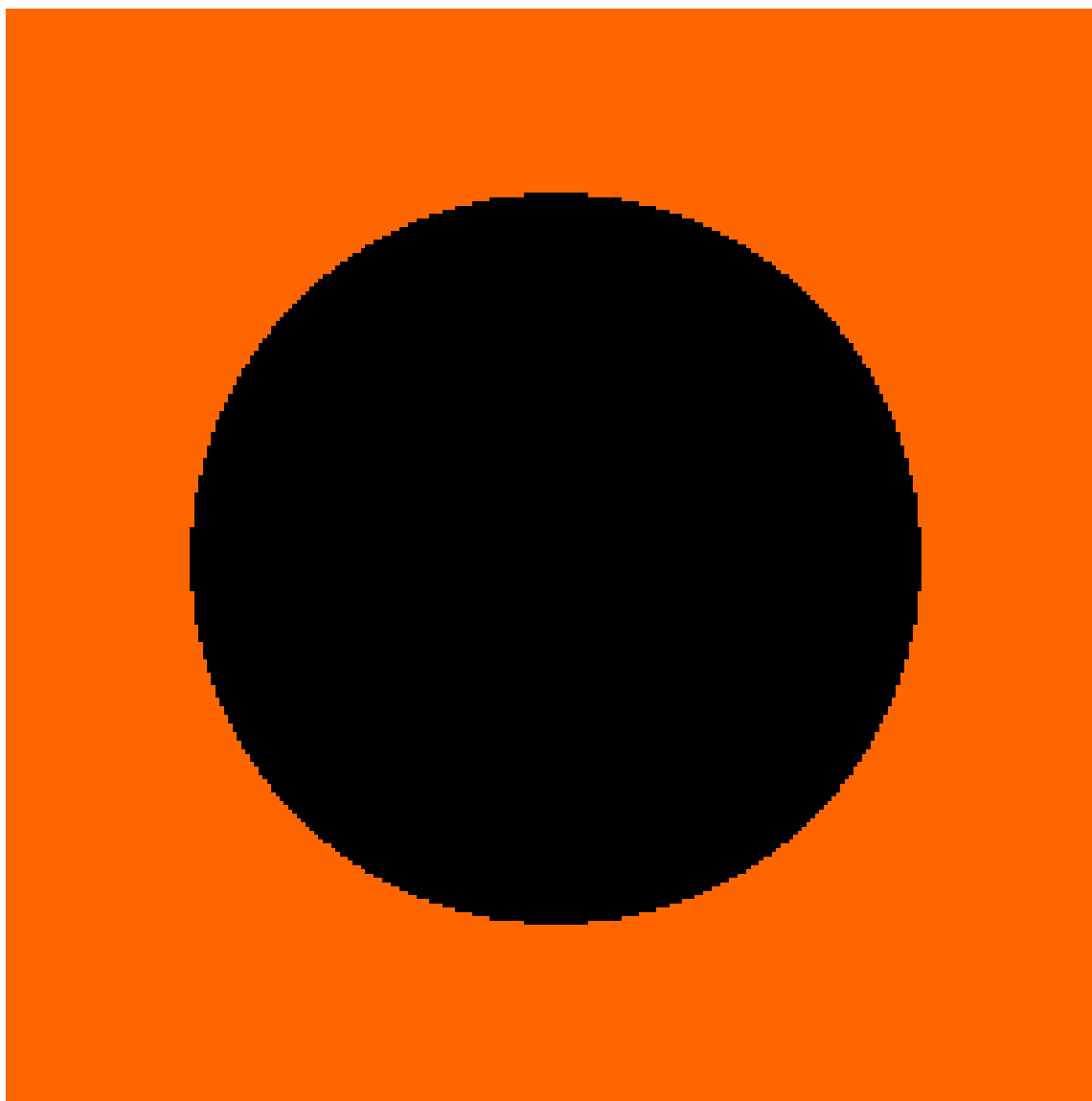
Initial image of a Mandelbrot set zoom sequence with a continuously colored environment

The **Mandelbrot set** is the set of complex numbers c for which the function $f_c(z) = z^2 + c$ does not diverge when iterated from $z = 0$, i.e., for which the sequence $f_c(0)$, $f_c(f_c(0))$, etc., remains bounded in absolute value.

Its definition and name are due to Adrien Douady, in tribute to the mathematician Benoit Mandelbrot.*[1] The set is connected to a Julia set, and related Julia sets produce similarly complex fractal shapes.

Mandelbrot set images may be created by sampling the complex numbers and determining, for each sample point c , whether the result of iterating the above function goes to infinity. Treating the real and imaginary parts of c as image coordinates $(x + yi)$ on the complex plane, pixels may then be colored according to how rapidly the sequence $z_n^2 + c$ diverges, with the color 0 (black) usually used for points where the sequence does not diverge. If c is held constant and the initial value of z_0 is variable instead, one obtains the corresponding Julia set for each point c in the parameter space of the simple function.

Images of the Mandelbrot set exhibit an elaborate and infinitely complicated boundary that reveals progressively ever-



Mandelbrot animation based on a static number of iterations per pixel

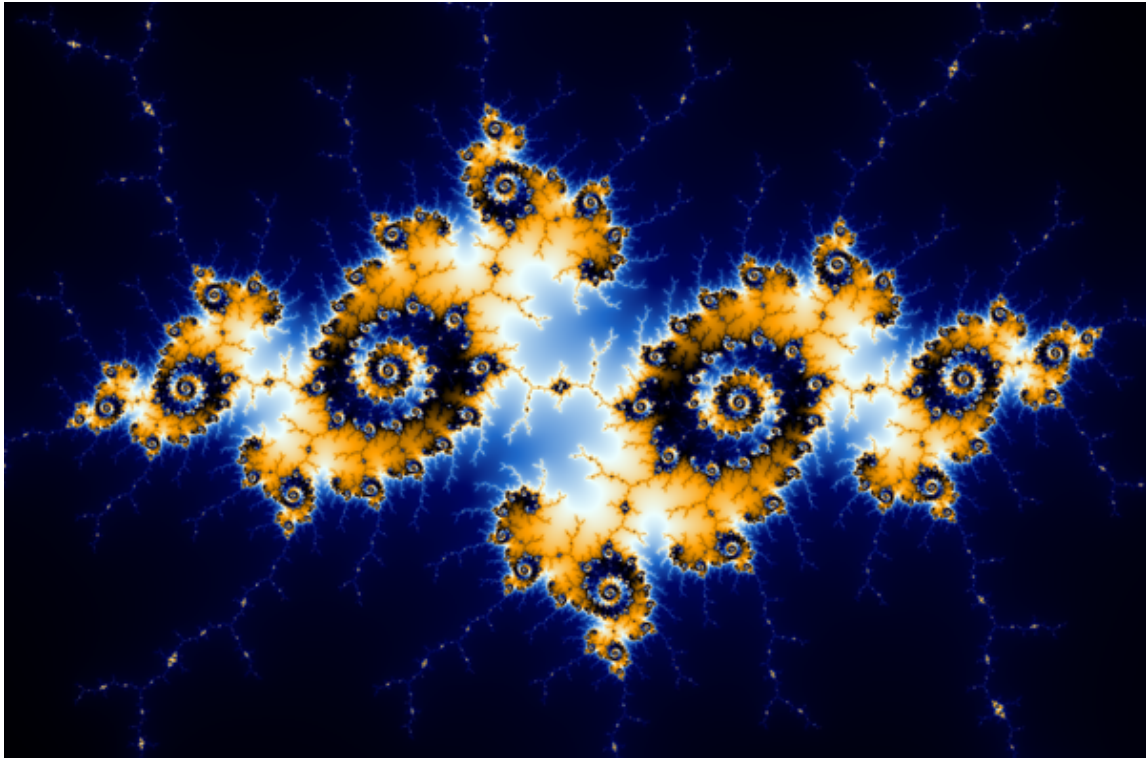
finer recursive detail at increasing magnifications. The “style” of this repeating detail depends on the region of the set being examined. The set's boundary also incorporates smaller versions of the main shape, so the fractal property of self-similarity applies to the entire set, and not just to its parts.

The Mandelbrot set has become popular outside mathematics both for its aesthetic appeal and as an example of a complex structure arising from the application of simple rules. It is one of the best-known examples of mathematical visualization.

26.1 History

The Mandelbrot set has its place in complex dynamics, a field first investigated by the French mathematicians Pierre Fatou and Gaston Julia at the beginning of the 20th century. This fractal was first defined and drawn in 1978 by Robert W. Brooks and Peter Matelski as part of a study of Kleinian groups.* [2] On 1 March 1980, at IBM's Thomas J. Watson Research Center in Yorktown Heights, New York, Benoit Mandelbrot first saw a visualization of the set.* [3]

Mandelbrot studied the parameter space of quadratic polynomials in an article that appeared in 1980.* [4] The mathematical study of the Mandelbrot set really began with work by the mathematicians Adrien Douady and John H. Hubbard,* [1] who established many of its fundamental properties and named the set in honor of Mandelbrot.



Mandelbrot set detail

The mathematicians Heinz-Otto Peitgen and Peter Richter became well known for promoting the set with photographs, books, ^[5] and an internationally touring exhibit of the German Goethe-Institut. ^[6] ^[7]

The cover article of the August 1985 *Scientific American* introduced a wide audience to the algorithm for computing the Mandelbrot set. The cover featured an image created by Peitgen, et al. ^[8] ^[9] The Mandelbrot set became prominent in the mid-1980s as a computer graphics demo, when personal computers became powerful enough to plot and display the set in high resolution. ^[10]

The work of Douady and Hubbard coincided with a huge increase in interest in complex dynamics and abstract mathematics, and the study of the Mandelbrot set has been a centerpiece of this field ever since. An exhaustive list of all the mathematicians who have contributed to the understanding of this set since then is beyond the scope of this article, but such a list would notably include Mikhail Lyubich, ^[11] ^[12] Curt McMullen, John Milnor, Mitsuhiro Shishikura, and Jean-Christophe Yoccoz.

26.2 Formal definition

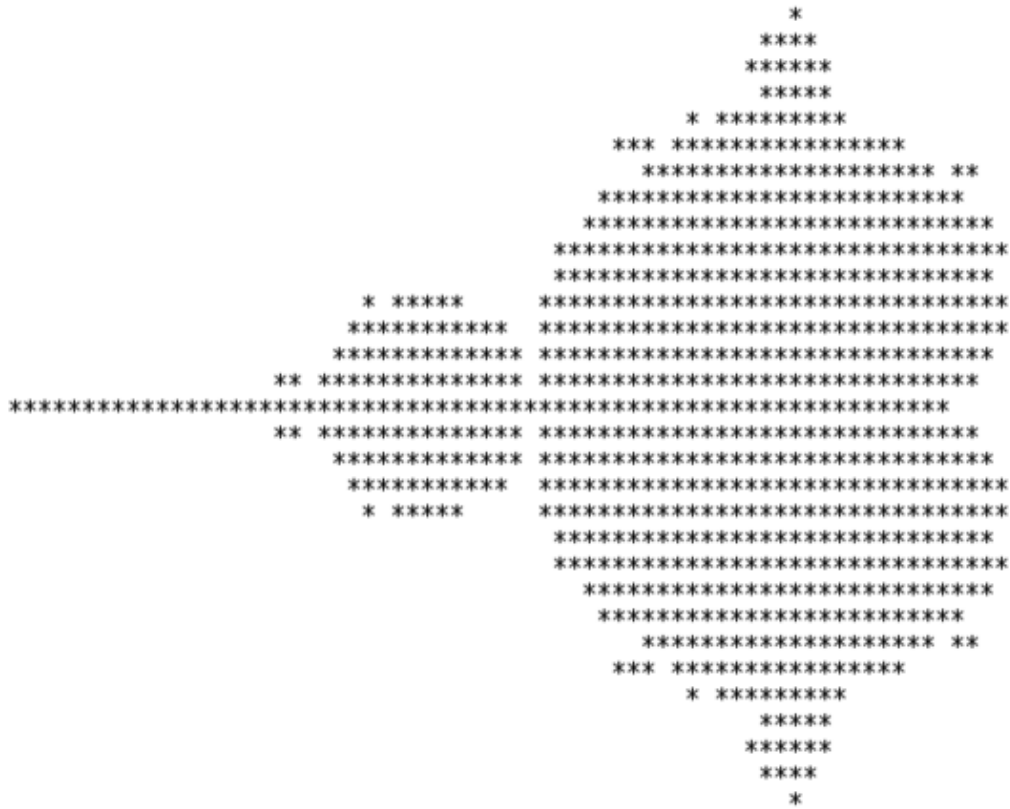
The Mandelbrot set is the set of values of c in the complex plane for which the orbit of 0 under iteration of the quadratic map

$$z_{n+1} = z_n^2 + c$$

remains bounded. ^[13] That is, a complex number c is part of the Mandelbrot set if, when starting with $z_0 = 0$ and applying the iteration repeatedly, the absolute value of z_n remains bounded however large n gets. This can also be represented as ^[14]

$$z_{n+1} = z_n^2 + c,$$

$$c \in M \iff \limsup_{n \rightarrow \infty} |z_{n+1}| \leq 2.$$



The first published picture of the Mandelbrot set, by Robert W. Brooks and Peter Matelski in 1978

For example, letting $c = 1$ gives the sequence $0, 1, 2, 5, 26, \dots$, which tends to infinity. As this sequence is unbounded, 1 is not an element of the Mandelbrot set. On the other hand, $c = -1$ gives the sequence $0, -1, 0, -1, 0, \dots$, which is bounded, and so -1 belongs to the Mandelbrot set.

The Mandelbrot set M is defined by a family of complex quadratic polynomials

$$P_c : \mathbb{C} \rightarrow \mathbb{C}$$

given by

$$P_c : z \mapsto z^2 + c,$$

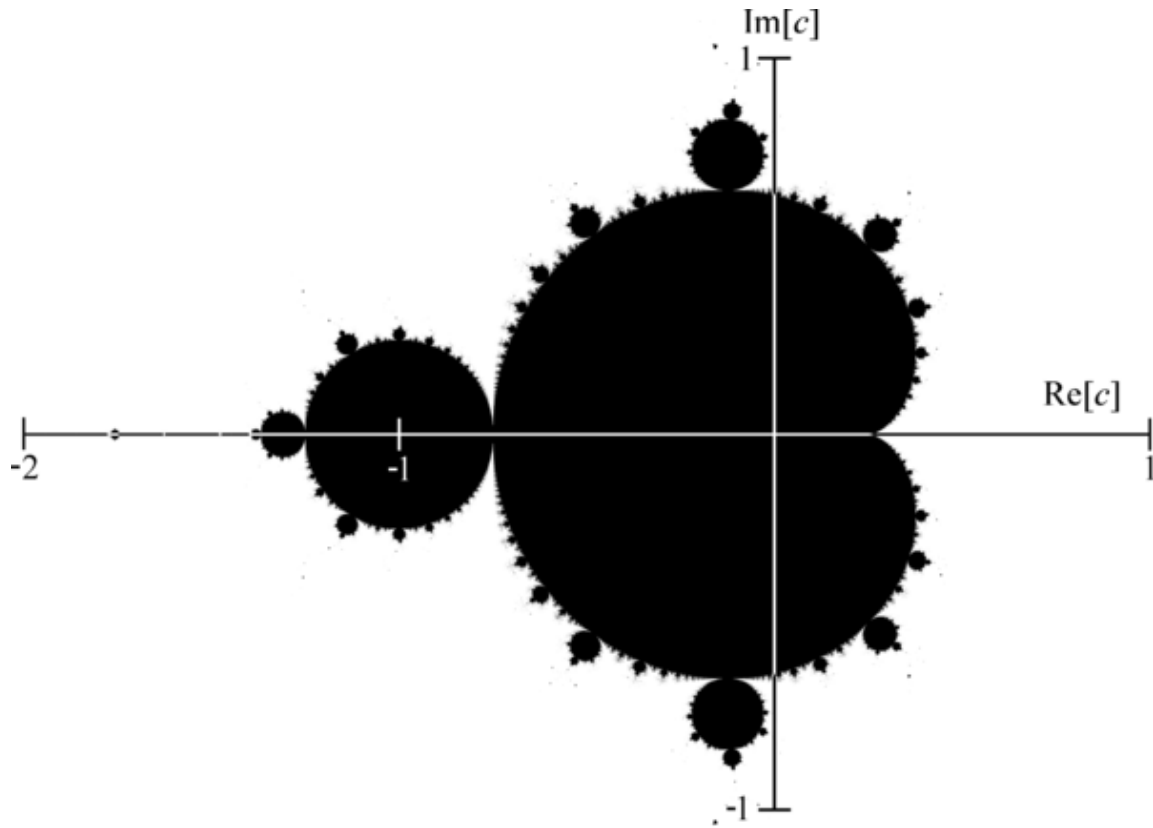
where c is a complex parameter. For each c , one considers the behavior of the sequence

$$(0, P_c(0), P_c(P_c(0)), P_c(P_c(P_c(0))), \dots)$$

obtained by iterating $P_c(z)$ starting at critical point $z = 0$, which either escapes to infinity or stays within a disk of some finite radius. The Mandelbrot set is defined as the set of all points c such that the above sequence does *not* escape to infinity.

More formally, if $P_c^n(z)$ denotes the n th iterate of $P_c(z)$ (i.e. $P_c(z)$ composed with itself n times), the Mandelbrot set is the subset of the complex plane given by

$$M = \{c \in \mathbb{C} : \exists s \in \mathbb{R}, \forall n \in \mathbb{N}, |P_c^n(0)| \leq s\}.$$



A mathematician's depiction of the Mandelbrot set M . A point c is colored black if it belongs to the set, and white if not. $\operatorname{Re}[c]$ and $\operatorname{Im}[c]$ denote the real and imaginary parts of c , respectively.

As explained below, it is in fact possible to simplify this definition by taking $s = 2$.

Mathematically, the Mandelbrot set is just a **set** of complex numbers. A given complex number c either belongs to M or it does not. A picture of the Mandelbrot set can be made by coloring all the points c that belong to M black, and all other points white. The more colorful pictures usually seen are generated by coloring points not in the set according to which term in the sequence $|P_c^n(0)|$ is the first term with an absolute value greater than a certain cutoff value, usually 2. See the section on **computer drawings** below for more details.

The Mandelbrot set can also be defined as the **connectedness locus** of the family of polynomials $P_c(z)$. That is, it is the subset of the complex plane consisting of those parameters c for which the **Julia set** of P_c is connected.

$P_c^n(0)$ is a polynomial in c and its leading terms settle down as n grows large enough. These terms are given by the **Catalan numbers**. The polynomials $P_c^n(0)$ are bounded by the **generating function** for the Catalan numbers and tend to it as n goes to infinity.

26.3 Basic properties

The Mandelbrot set is a **compact set**, since it is **closed** and contained in the **closed disk** of radius 2 around the origin. More specifically, a point c belongs to the Mandelbrot set if and only if

$$|P_c^n(0)| \leq 2 \text{ for all } n \geq 0.$$

In other words, if the **absolute value** of $P_c^n(0)$ ever becomes larger than 2, the sequence will escape to infinity.

The **intersection** of M with the real axis is precisely the interval $[-2, 1/4]$. The parameters along this interval can be put in one-to-one correspondence with those of the real **logistic family**,

$$z \mapsto \lambda z(1 - z), \quad \lambda \in [1, 4].$$



Correspondence between the Mandelbrot set and the bifurcation diagram of the logistic map

The correspondence is given by

$$c = \frac{\lambda}{2} \left(1 - \frac{\lambda}{2} \right).$$

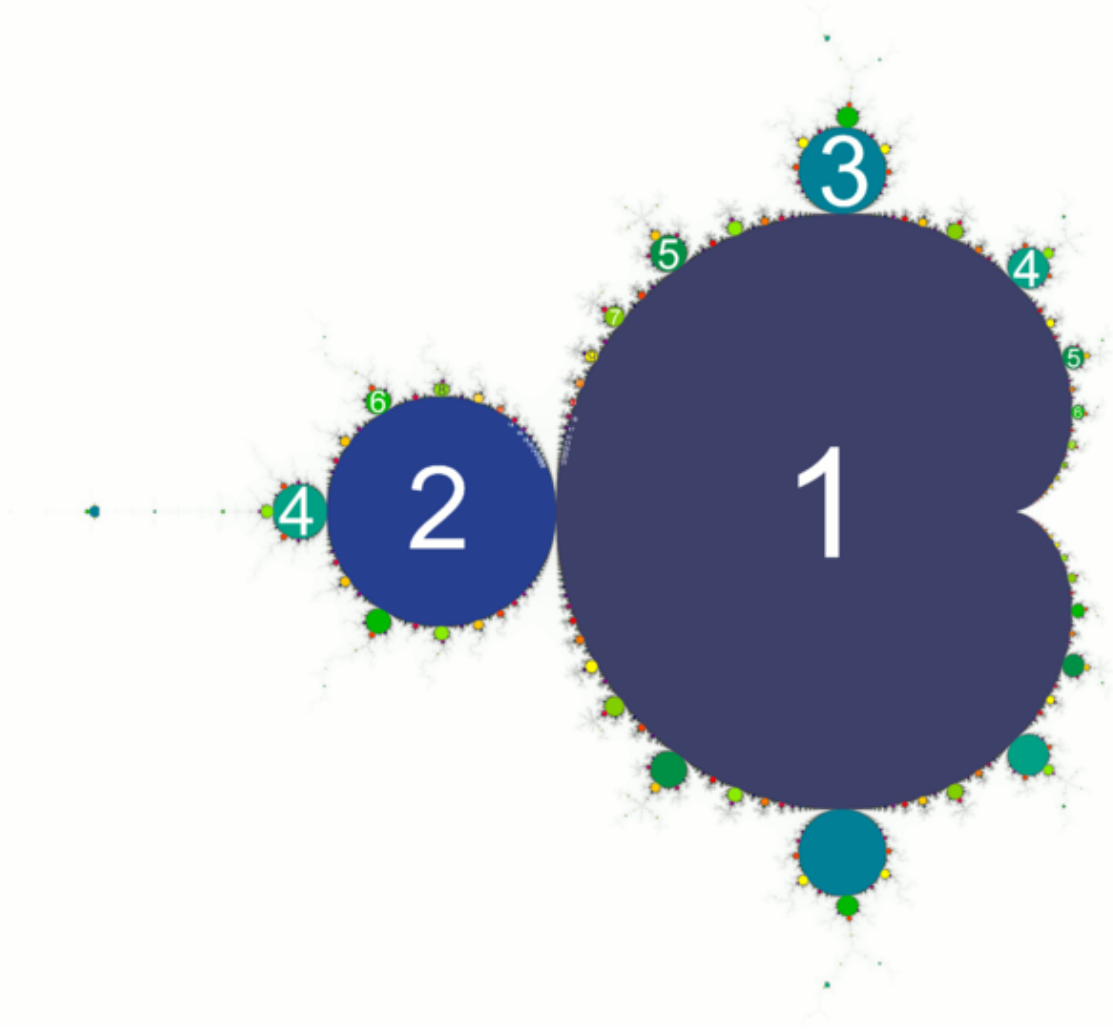
In fact, this gives a correspondence between the entire **parameter space** of the logistic family and that of the Mandelbrot set.

As of October 2012, the area of the Mandelbrot is estimated to be $1.5065918849 \pm 0.0000000028$.* [15]

The dynamical formula for the **uniformisation** of the complement of the Mandelbrot set, arising from Douady and Hubbard's proof of the connectedness of M , gives rise to **external rays** of the Mandelbrot set. These rays can be used to study the Mandelbrot set in combinatorial terms and form the backbone of the Yoccoz parapuzzle.^{*} [16]

26.4 Other properties

26.4.1 Main cardioid and period bulbs



Periods of hyperbolic components

Upon looking at a picture of the Mandelbrot set, one immediately notices the large **cardioid**-shaped region in the center. This *main cardioid* is the region of parameters c for which P_c has an **attracting fixed point**. It consists of all parameters of the form

$$c = \frac{\mu}{2} \left(1 - \frac{\mu}{2} \right)$$

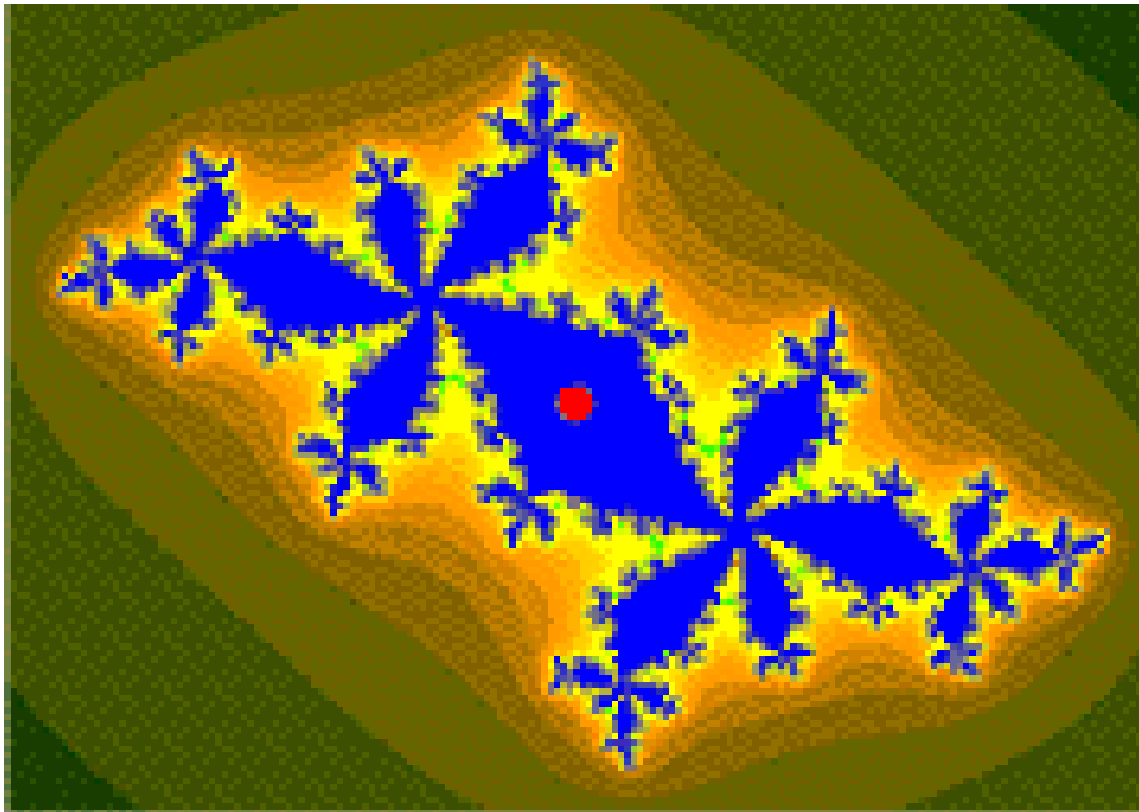
for some μ in the **open unit disk**.

To the left of the main cardioid, attached to it at the point $c = -3/4$, a circular-shaped **bulb** is visible. This bulb consists of those parameters c for which P_c has an **attracting cycle of period 2**. This set of parameters is an actual circle, namely that of radius $1/4$ around -1 .

There are infinitely many other bulbs tangent to the main cardioid: for every rational number $\frac{p}{q}$, with p and q **coprime**, there is such a bulb that is tangent at the parameter

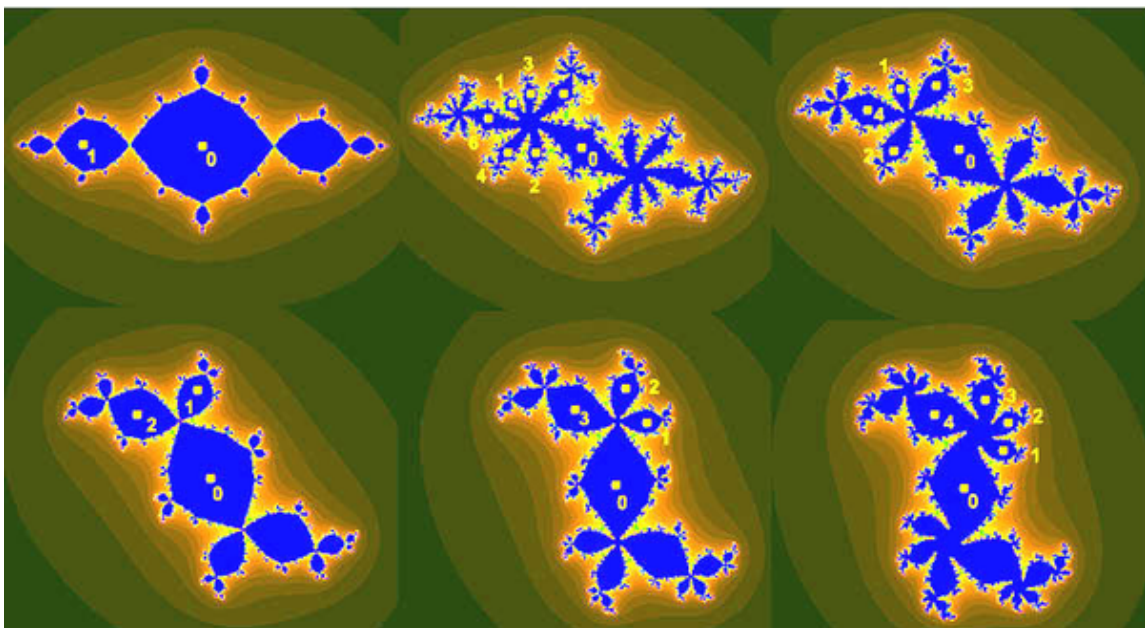
$$c_{\frac{p}{q}} = \frac{e^{2\pi i \frac{p}{q}}}{2} \left(1 - \frac{e^{2\pi i \frac{p}{q}}}{2} \right).$$

This bulb is called the $\frac{p}{q}$ -*bulb* of the Mandelbrot set. It consists of parameters that have an attracting cycle of period



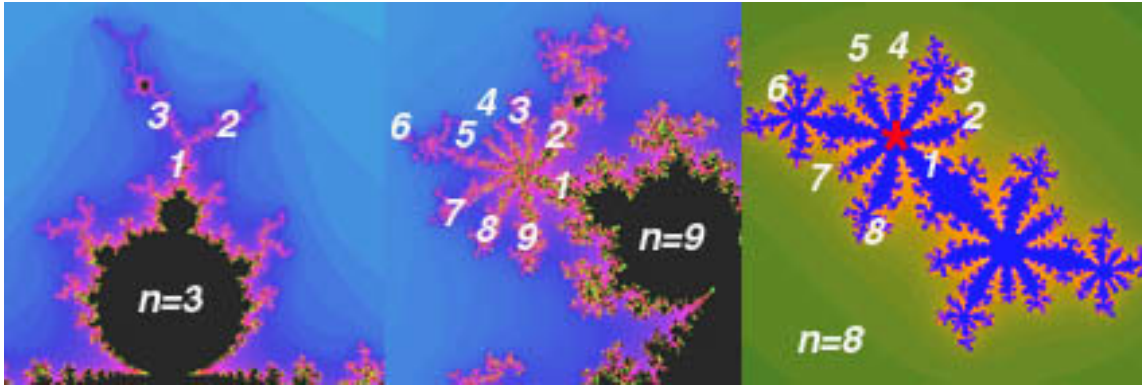
Attracting cycle in 2/5-bulb plotted over *Julia set* (animation)

q and combinatorial rotation number $\frac{p}{q}$. More precisely, the q periodic Fatou components containing the attracting cycle all touch at a common point (commonly called the α -fixed point). If we label these components U_0, \dots, U_{q-1} in counterclockwise orientation, then P_c maps the component U_j to the component $U_{j+p \pmod{q}}$.



Attracting cycles and *Julia sets* for parameters in the 1/2, 3/7, 2/5, 1/3, 1/4, and 1/5 bulbs

The change of behavior occurring at $c_{\frac{p}{q}}$ is known as a bifurcation: the attracting fixed point “collides” with a repelling period q -cycle. As we pass through the bifurcation parameter into the $\frac{p}{q}$ -bulb, the attracting fixed point turns into a



Cycle periods and antennae

repelling fixed point (the α -fixed point), and the period q -cycle becomes attracting.

26.4.2 Hyperbolic components

All the bulbs we encountered in the previous section were interior components of the Mandelbrot set in which the maps P_c have an attracting periodic cycle. Such components are called *hyperbolic components*.

It is conjectured that these are the *only* interior regions of M . This problem, known as *density of hyperbolicity*, may be the most important open problem in the field of complex dynamics. Hypothetical non-hyperbolic components of the Mandelbrot set are often referred to as “queer” or ghost components. ^[17]^[18] For *real* quadratic polynomials, this question was answered positively in the 1990s independently by Lyubich and by Graczyk and Świątek. (Note that hyperbolic components intersecting the real axis correspond exactly to periodic windows in the *Feigenbaum diagram*. So this result states that such windows exist near every parameter in the diagram.)

Not every hyperbolic component can be reached by a sequence of direct bifurcations from the main cardioid of the Mandelbrot set. However, such a component *can* be reached by a sequence of direct bifurcations from the main cardioid of a little Mandelbrot copy (see below).

Each of the hyperbolic components has a *center*, which is a point c such that the inner Fatou domain for $P_c(z)$ has a super-attracting cycle – that is, that the attraction is infinite (see the image [here](#)). This means that the cycle contains the critical point 0, so that 0 is iterated back to itself after some iterations. We therefore have that $P_c^{*n}(0) = 0$ for some n . If we call this polynomial $Q^n(c)$ (letting it depend on c instead of z), we have that $Q^{n+1}(c) = Q^n(c)^2 + c$ and that the degree of $Q^n(c)$ is 2^{n-1} . We can therefore construct the centers of the hyperbolic components by successively solving the equations $Q^n(c) = 0$, $n = 1, 2, 3, \dots$. Note that for each step, we get just as many new centers as we have found so far.

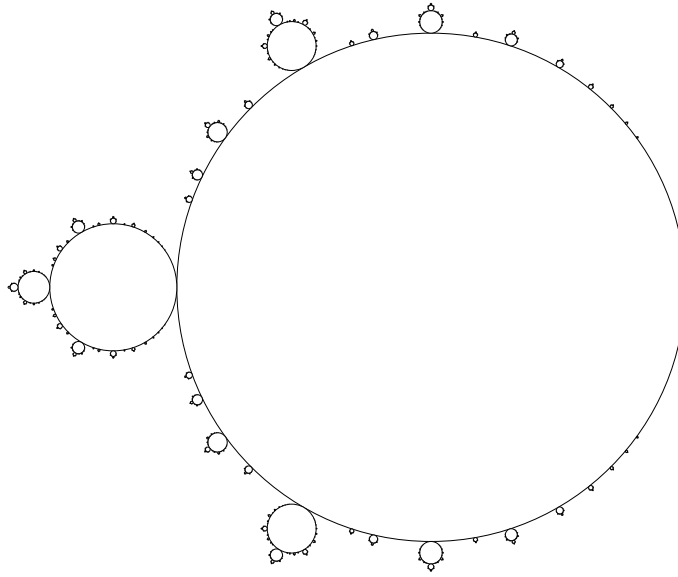
26.4.3 Local connectivity

It is conjectured that the Mandelbrot set is *locally connected*. This famous conjecture is known as *MLC* (for *Mandelbrot Locally Connected*). By the work of *Adrien Douady* and *John H. Hubbard*, this conjecture would result in a simple abstract “pinched disk” model of the Mandelbrot set. In particular, it would imply the important *hyperbolicity conjecture* mentioned above.

The work of *Jean-Christophe Yoccoz* established local connectivity of the Mandelbrot set at all finitely renormalizable parameters; that is, roughly speaking those contained only in finitely many small Mandelbrot copies. ^[19] Since then, local connectivity has been proved at many other points of M , but the full conjecture is still open.

26.4.4 Self-similarity

The Mandelbrot set is *self-similar* under magnification in the neighborhoods of the *Misiurewicz points*. It is also conjectured to be self-similar around generalized *Feigenbaum points* (e.g., -1.401155 or $-0.1528 + 1.0397i$), in the sense of converging to a limit set. ^[20]^[21]



Topological model of Mandelbrot set without mini Mandelbrot sets and Misiurewicz points (Cactus model)

The Mandelbrot set in general is not strictly self-similar but it is quasi-self-similar, as small slightly different versions of itself can be found at arbitrarily small scales.

The little copies of the Mandelbrot set are all slightly different, mostly because of the thin threads connecting them to the main body of the set.

26.4.5 Further results

The Hausdorff dimension of the boundary of the Mandelbrot set equals 2 as determined by a result of Mitsuhiro Shishikura.* [22] It is not known whether the boundary of the Mandelbrot set has positive planar Lebesgue measure.

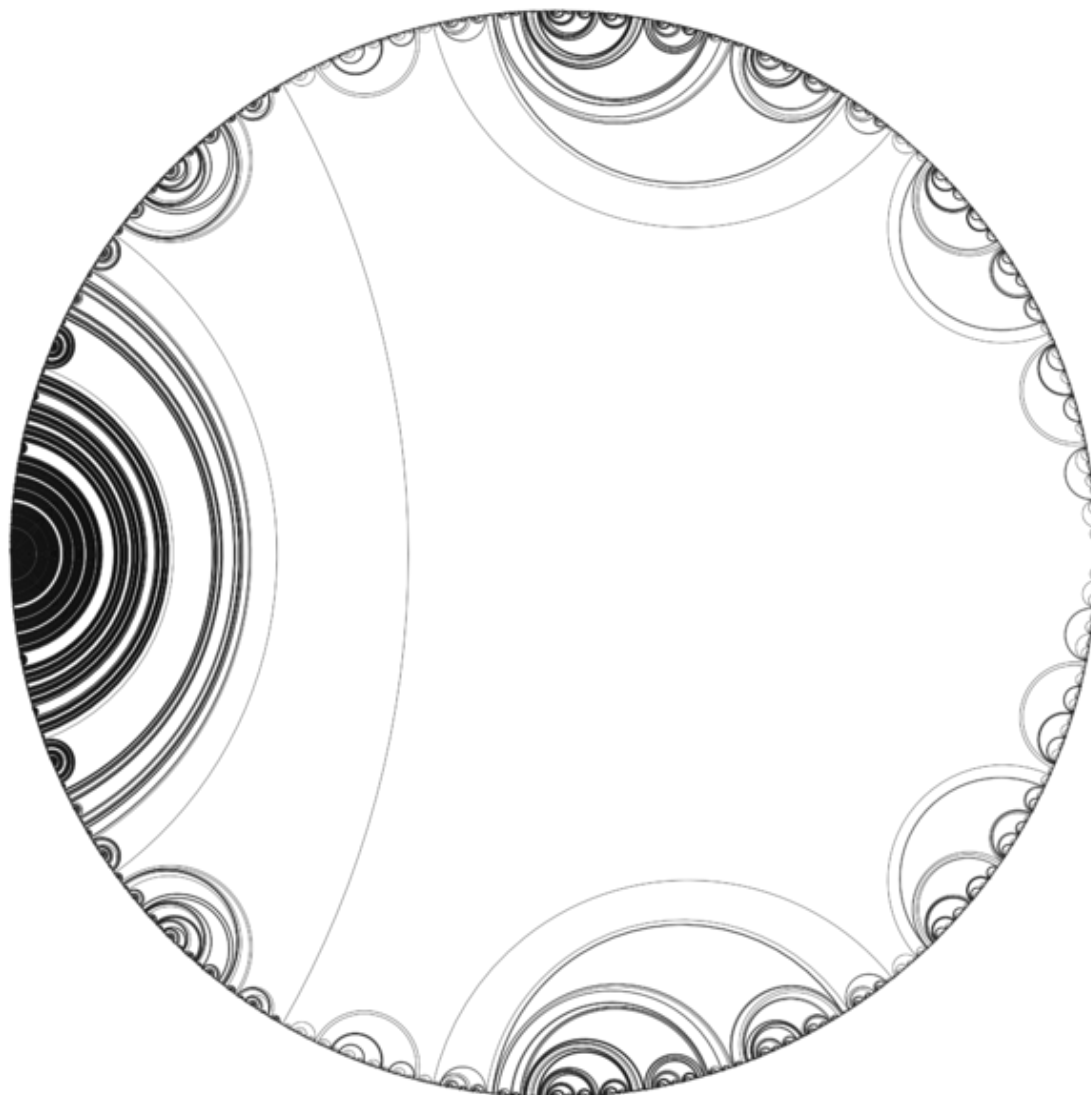
In the Blum-Shub-Smale model of real computation, the Mandelbrot set is not computable, but its complement is computably enumerable. However, many simple objects (e.g., the graph of exponentiation) are also not computable in the BSS model. At present, it is unknown whether the Mandelbrot set is computable in models of real computation based on computable analysis, which correspond more closely to the intuitive notion of “plotting the set by a computer”. Hertling has shown that the Mandelbrot set is computable in this model if the hyperbolicity conjecture is true.

The occurrence of π in the Mandelbrot set was discovered by David Boll in 1991.* [23] He found that when looking at the pinch points of the Mandelbrot set, the number of iterations needed for the point $(-3/4, \varepsilon)$ before escaping, multiplied by ε , was equal to π . Based on this initial finding, Aaron Klebanoff developed a further test near another pinch point $(1/4 + \varepsilon, 0)$ in the Mandelbrot set and found that the number of iterations times the square root of ε was equal to π .

26.4.6 Relationship with Julia sets

As a consequence of the definition of the Mandelbrot set, there is a close correspondence between the geometry of the Mandelbrot set at a given point and the structure of the corresponding Julia set. For instance, a point is in the Mandelbrot set exactly when the corresponding Julia set is connected.

This principle is exploited in virtually all deep results on the Mandelbrot set. For example, Shishikura proves that,



Thurston model of Mandelbrot set (abstract Mandelbrot set)

for a dense set of parameters in the boundary of the Mandelbrot set, the Julia set has Hausdorff dimension two, and then transfers this information to the parameter plane.*[22] Similarly, Yoccoz first proved the local connectivity of Julia sets, before establishing it for the Mandelbrot set at the corresponding parameters.*[19] Adrien Douady phrases this principle as:

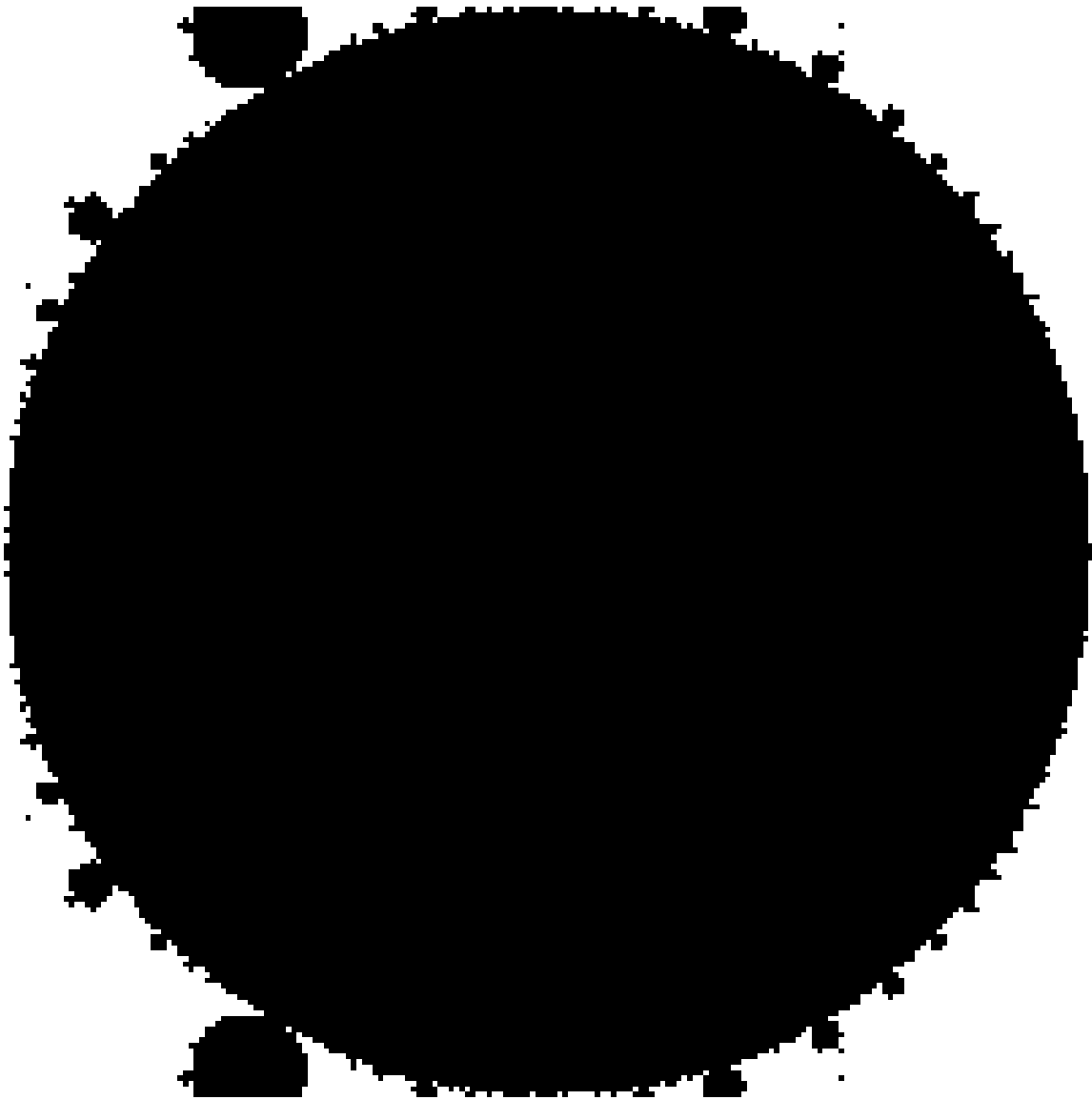
Plough in the dynamical plane, and harvest in parameter space.

26.5 Geometry

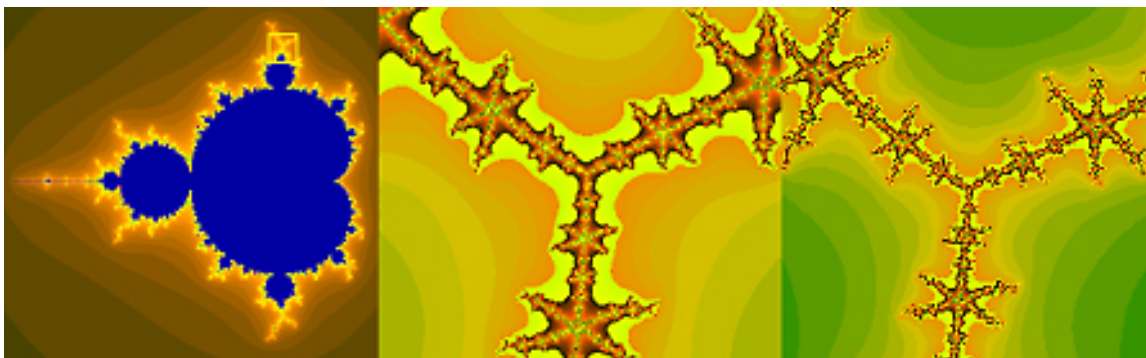
For every rational number $\frac{p}{q}$, where p and q are relatively prime, a hyperbolic component of period q bifurcates from the main cardioid. The part of the Mandelbrot set connected to the main cardioid at this bifurcation point is called the **p/q -limb**. Computer experiments suggest that the diameter of the limb tends to zero like $\frac{1}{q^2}$. The best current estimate known is the *Yoccoz-inequality*, which states that the size tends to zero like $\frac{1}{q}$.

A period- q limb will have $q - 1$ “antennae” at the top of its limb. We can thus determine the period of a given bulb by counting these antennae.

In an attempt to demonstrate that the thickness of the p/q -limb is zero, David Boll carried out a computer experiment

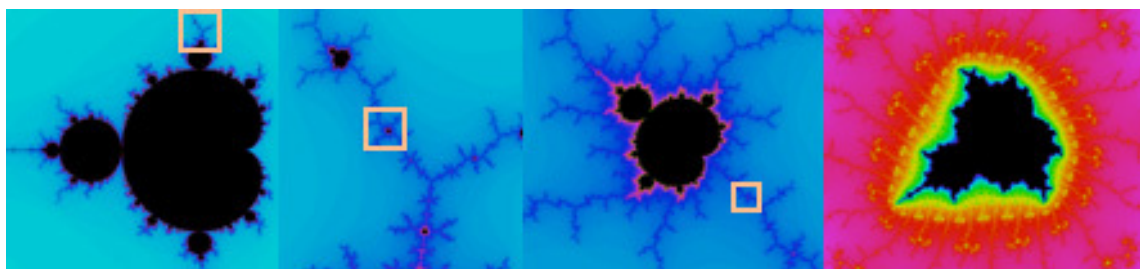


Self-similarity in the Mandelbrot set shown by zooming in on a round feature while panning in the negative- x direction. The display center pans from $(-1, 0)$ to $(-1.31, 0)$ while the view magnifies from 0.5×0.5 to 0.12×0.12 to approximate the Feigenbaum ratio δ .



Self-similarity around Misiurewicz point $-0.1011 + 0.9563i$.

in 1991, where he computed the number of iterations required for the series to converge for $z = -\frac{3}{4} + i\epsilon$ ($-\frac{3}{4}$ being the location thereof). As the series doesn't converge for the exact value of $z = -\frac{3}{4}$, the number of iterations required increases with a small ϵ . It turns out that multiplying the value of ϵ with the number of iterations required yields an



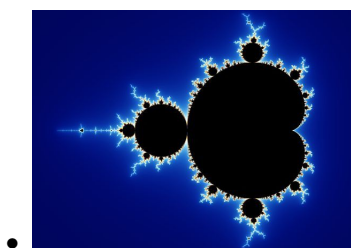
Quasi-self-similarity in the Mandelbrot set

approximation of π that becomes better for smaller ε . For example, for $\varepsilon = 0.0000001$ the number of iterations is 31415928 and the product is 3.1415928.*[24]

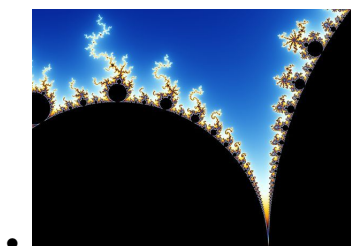
26.5.1 Image gallery of a zoom sequence

The Mandelbrot set shows more intricate detail the closer one looks or **magnifies** the image, usually called “zooming in”. The following example of an image sequence zooming to a selected c value gives an impression of the infinite richness of different geometrical structures and explains some of their typical rules.

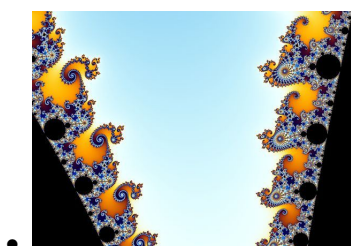
The magnification of the last image relative to the first one is about 10^{10} to 1. Relating to an ordinary monitor, it represents a section of a Mandelbrot set with a diameter of 4 million kilometers. Its border would show an astronomical number of different fractal structures.



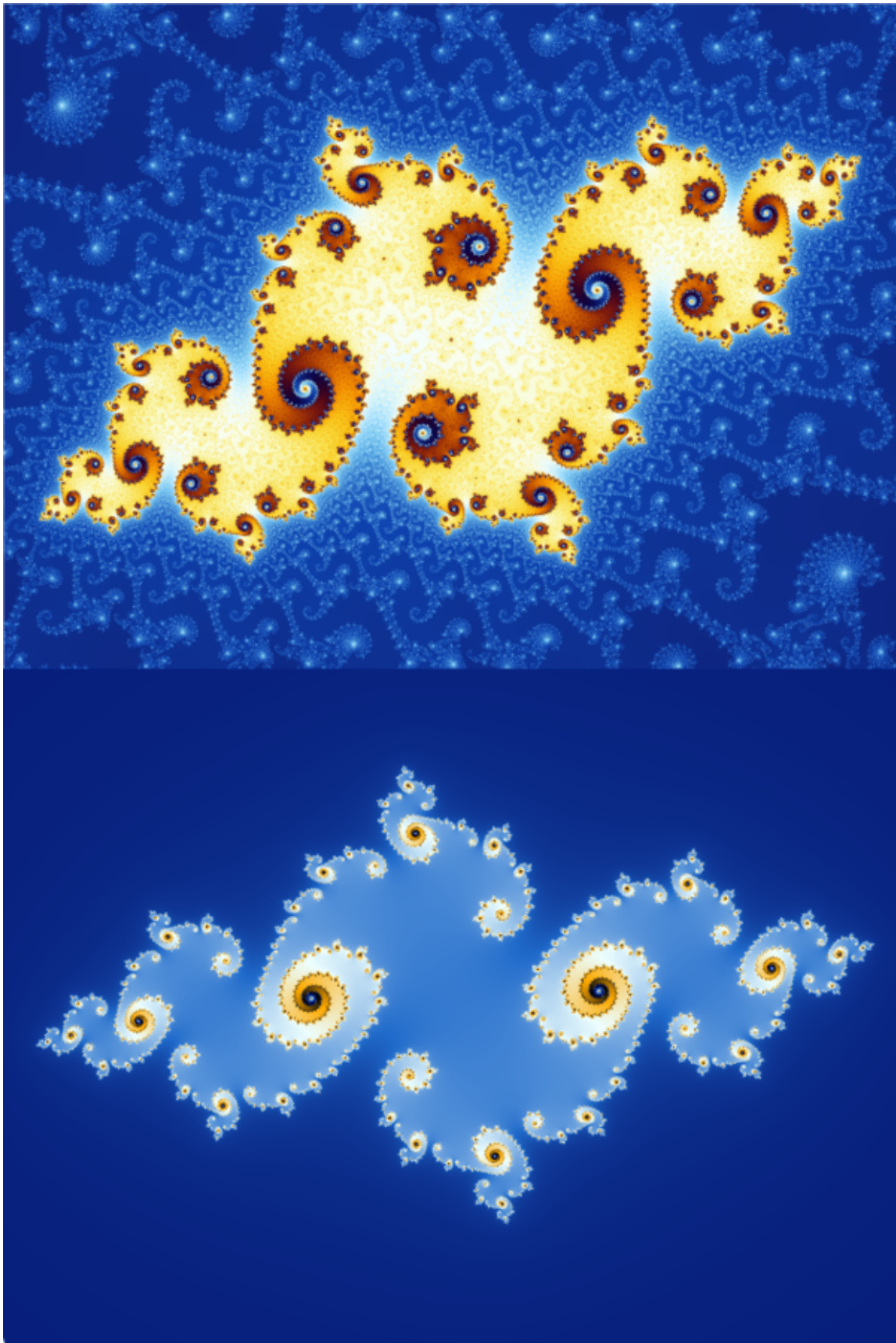
- Start. Mandelbrot set with continuously colored environment.



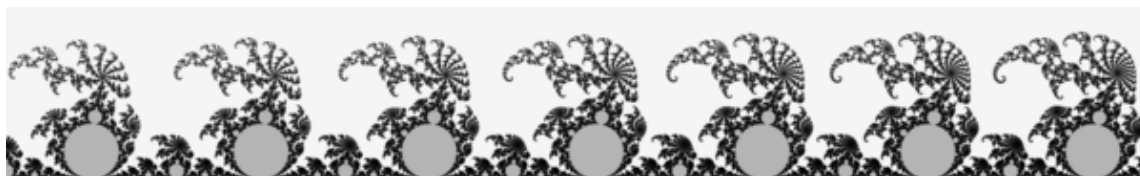
- Gap between the “head” and the “body”, also called the “seahorse valley”



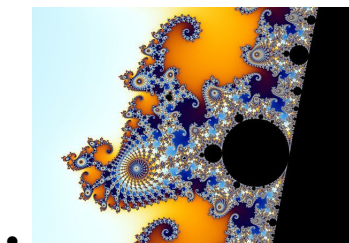
- Double-spirals on the left, “seahorses” on the right



A zoom into the Mandelbrot set illustrating a Julia “island” and the corresponding Julia set of the form $f_c(z) = z^2 + c$, in which c is the center of the Mandelbrot set zoom-in

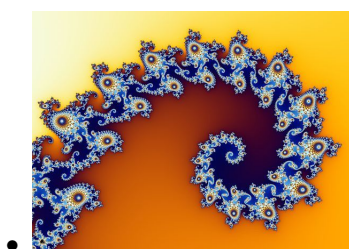


Components on main cardioid for periods 8–14 with antennae 7–13

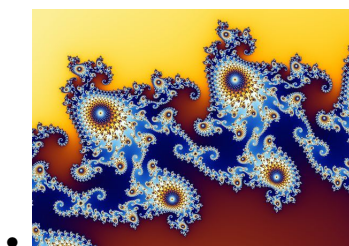


- “Seahorse” upside down

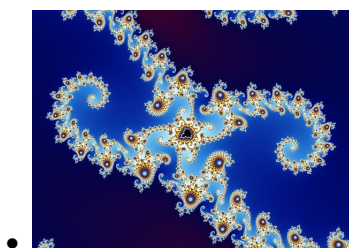
The seahorse “body” is composed by 25 “spokes” consisting of two groups of 12 “spokes” each and one “spoke” connecting to the main cardioid. These two groups can be attributed by some kind of metamorphosis to the two “fingers” of the “upper hand” of the Mandelbrot set; therefore, the number of “spokes” increases from one “seahorse” to the next by 2; the “hub” is a so-called **Misiurewicz point**. Between the “upper part of the body” and the “tail” a distorted small copy of the Mandelbrot set called satellite may be recognized.



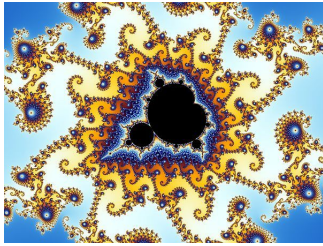
- The central endpoint of the “seahorse tail” is also a **Misiurewicz point**.



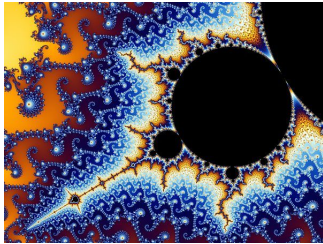
- Part of the “tail” —there is only one path consisting of the thin structures that lead through the whole “tail”. This zigzag path passes the “hubs” of the large objects with 25 “spokes” at the inner and outer border of the “tail”; thus the Mandelbrot set is a **simply connected** set, which means there are no islands and no loop roads around a hole.



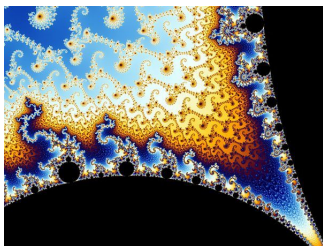
- Satellite. The two “seahorse tails” are the beginning of a series of concentric crowns with the satellite in the center. [Open this location in an interactive viewer.](#)



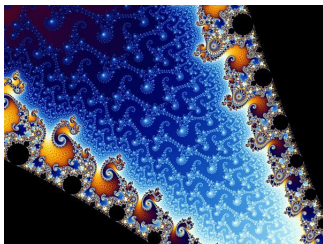
- Each of these crowns consists of similar “seahorse tails”; their number increases with powers of 2, a typical phenomenon in the environment of satellites. The unique path to the spiral center passes the satellite from the groove of the cardioid to the top of the “antenna” on the “head” .



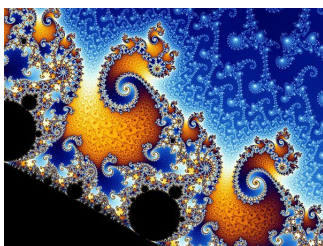
- “Antenna” of the satellite. Several satellites of second order may be recognized.



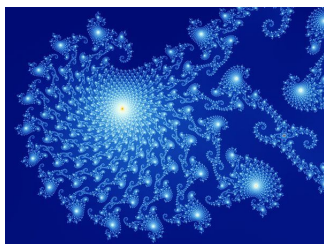
- The “seahorse valley” of the satellite. All the structures from the start of the zoom reappear.



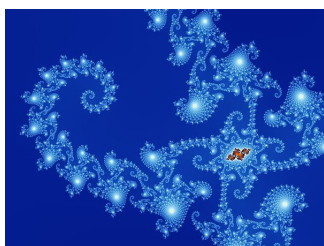
- Double-spirals and “seahorses” – unlike the 2nd image from the start, they have appendices consisting of structures like “seahorse tails”; this demonstrates the typical linking of $n + 1$ different structures in the environment of satellites of the order n , here for the simplest case $n = 1$.



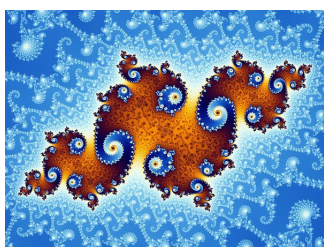
- Double-spirals with satellites of second order – analogously to the “seahorses” , the double-spirals may be interpreted as a metamorphosis of the “antenna”



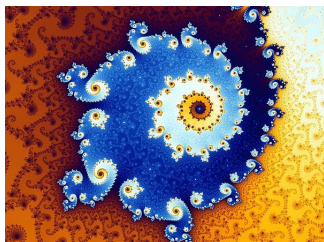
- In the outer part of the appendices, islands of structures may be recognized; they have a shape like Julia sets J_c ; the largest of them may be found in the center of the “double-hook” on the right side



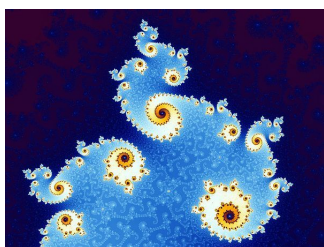
- Part of the “double-hook”



- Islands



- Detail of one island

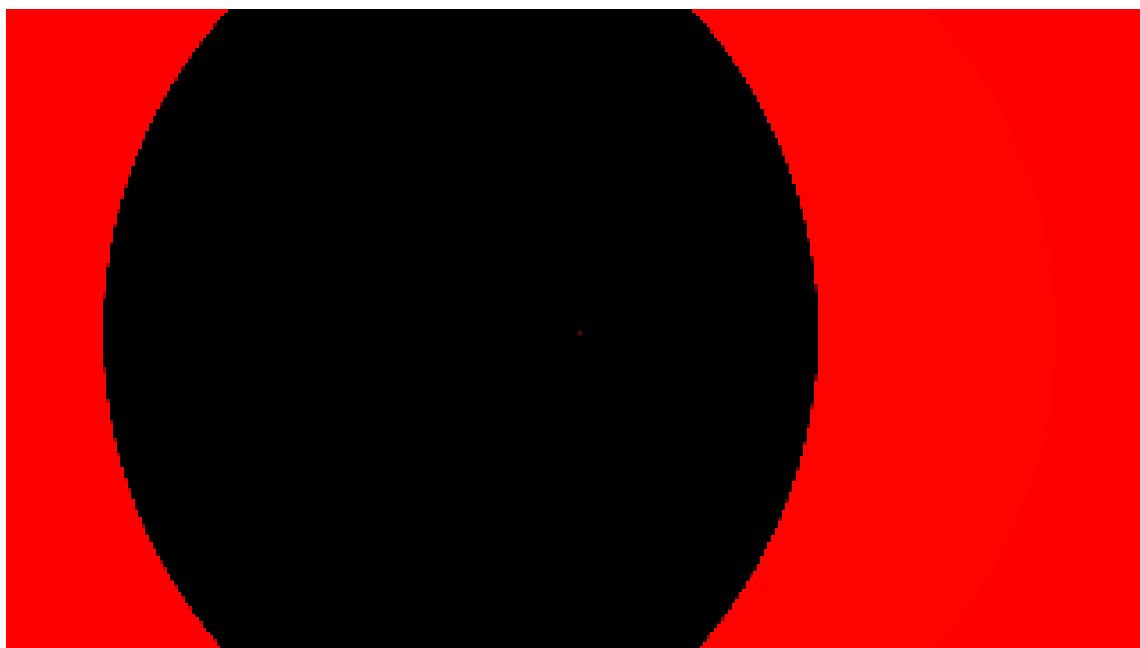


- Detail of the spiral

The islands above seem to consist of infinitely many parts like Cantor sets, as is actually the case for the corresponding Julia set J_c . However, they are connected by tiny structures, so that the whole represents a simply connected set. The tiny structures meet each other at a satellite in the center that is too small to be recognized at this magnification. The value of c for the corresponding J_c is not that of the image center but, relative to the main body of the Mandelbrot set, has the same position as the center of this image relative to the satellite shown in the 6th zoom step.

26.6 Generalizations

Multibrot sets are bounded sets found in the complex plane for members of the general monic univariate polynomial



Animation of the Mandelbrot set for d from 0 to 5

family of recursions

$$z \mapsto z^d + c.$$

For integer d , these sets are connectedness loci for the Julia sets built from the same formula. The full **cubic connectedness map** has also been studied; here one considers the two-parameter recursion $z \mapsto z^3 + 3kz + c$, whose two **critical points** are the **complex square roots** of the parameter k . A point is in the map if either critical point is stable.* [25]

For general families of holomorphic functions, the *boundary* of the Mandelbrot set generalizes to the **bifurcation locus**, which is a natural object to study even when the connectedness locus is not useful.

26.7 Other, non-analytic, mappings

Of particular interest is the **tricorn** fractal, the connectedness locus of the anti-holomorphic family

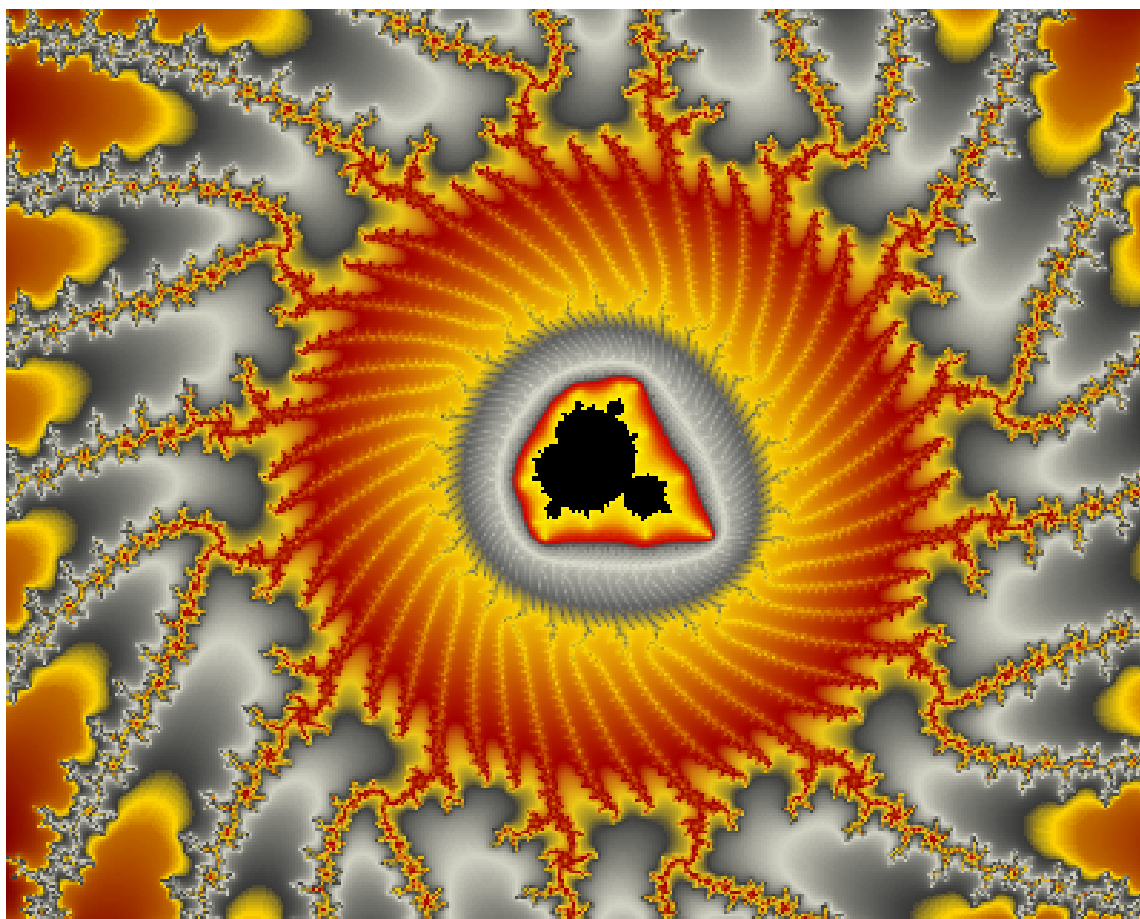
$$z \mapsto \bar{z}^2 + c.$$

The tricorn (also sometimes called the *Mandelbar set*) was encountered by **Milnor** in his study of parameter slices of real cubic polynomials. It is *not* locally connected. This property is inherited by the connectedness locus of real cubic polynomials.

Another non-analytic generalization is the Burning Ship fractal, which is obtained by iterating the mapping

$$z \mapsto (|\Re(z)| + i|\Im(z)|)^2 + c.$$

The **Multibrot set** is obtained by varying the value of the exponent d . The article has a video that shows the development from $d = 0$ to 7, at which point there are 6 i.e. $(d - 1)$ lobes around the perimeter. A similar development with negative exponents results in $(1 - d)$ clefts on the inside of a ring.



Still image of a movie of increasing magnification on $0.001643721971153 - 0.822467633298876i$

26.8 Computer drawings

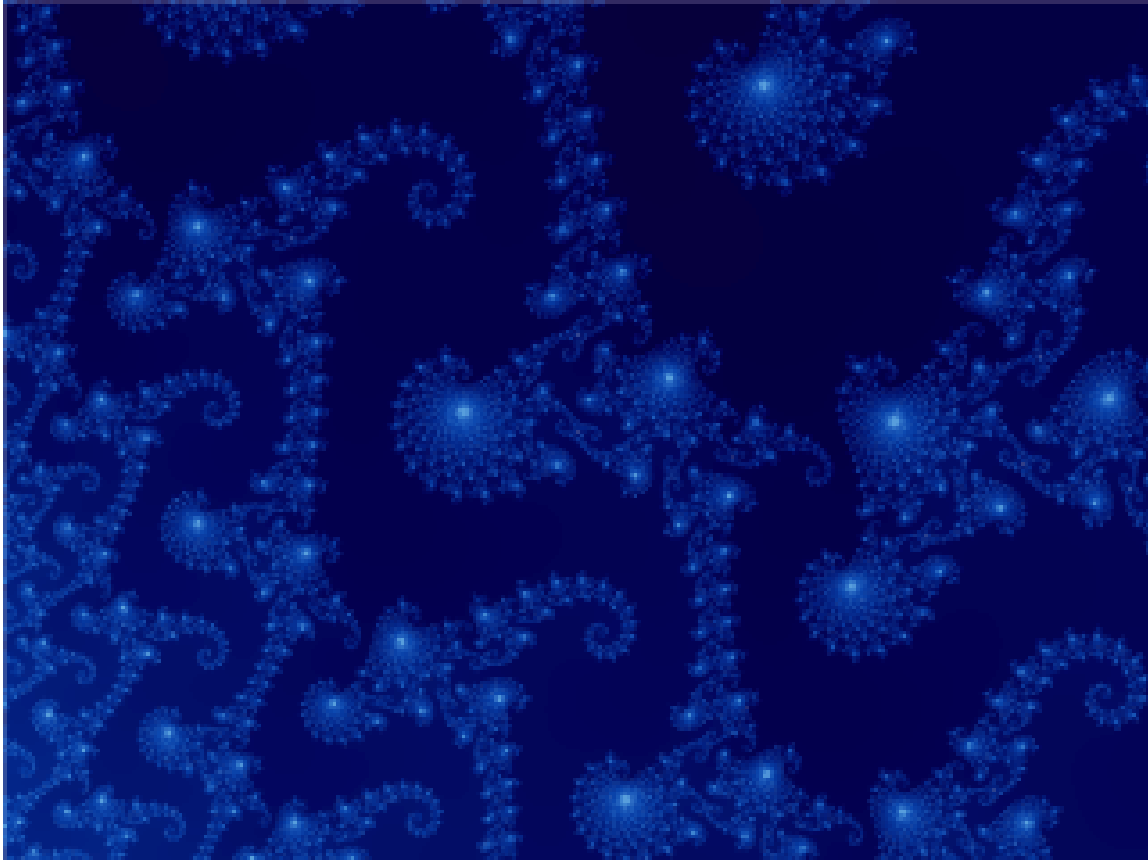
There are many programs used to generate the Mandelbrot set and other fractals, some of which are described in [fractal-generating software](#). These programs use a variety of algorithms to determine the color of individual pixels and achieve efficient computation.

26.8.1 Escape time algorithm

The simplest algorithm for generating a representation of the Mandelbrot set is known as the “escape time” algorithm. A repeating calculation is performed for each x, y point in the plot area and based on the behavior of that calculation, a color is chosen for that pixel.

The x and y locations of each point are used as starting values in a repeating, or iterating calculation (described in detail below). The result of each iteration is used as the starting values for the next. The values are checked during each iteration to see whether they have reached a critical “escape” condition, or “bailout”. If that condition is reached, the calculation is stopped, the pixel is drawn, and the next x, y point is examined. For some starting values, escape occurs quickly, after only a small number of iterations. For starting values very close to but not in the set, it may take hundreds or thousands of iterations to escape. For values within the Mandelbrot set, escape will never occur. The programmer or user must choose how much iteration, or “depth”, they wish to examine. The higher the maximal number of iterations, the more detail and subtlety emerge in the final image, but the longer time it will take to calculate the fractal image.

Escape conditions can be simple or complex. Because no complex number with a real or imaginary part greater than 2 can be part of the set, a common bailout is to escape when either coefficient exceeds 2. A more computationally complex method that detects escapes sooner, is to compute distance from the origin using the [Pythagorean theorem](#), i.e., to determine the [absolute value](#), or *modulus*, of the complex number. If this value exceeds 2, the point has



Still image of an animation of increasing magnification

reached escape. More computationally intensive rendering variations include the **Buddhabrot** method, which finds escaping points and plots their iterated coordinates.

The color of each point represents how quickly the values reached the escape point. Often black is used to show values that fail to escape before the iteration limit, and gradually brighter colors are used for points that escape. This gives a visual representation of how many cycles were required before reaching the escape condition.

To render such an image, the region of the complex plane we are considering is subdivided into a certain number of **pixels**. To color any such pixel, let c be the midpoint of that pixel. We now iterate the critical point 0 under P_c , checking at each step whether the orbit point has modulus larger than 2. When this is the case, we know that c does not belong to the Mandelbrot set, and we color our pixel according to the number of iterations used to find out. Otherwise, we keep iterating up to a fixed number of steps, after which we decide that our parameter is “probably” in the Mandelbrot set, or at least very close to it, and color the pixel black.

In **pseudocode**, this algorithm would look as follows. The algorithm does not use complex numbers and manually simulates complex-number operations using two real numbers, for those who do not have a **complex data type**. The program may be simplified if the programming language includes complex-data-type operations.

For each pixel (Px, Py) on the screen, do: { x_0 = scaled x coordinate of pixel (scaled to lie in the Mandelbrot X scale $(-2.5, 1)$) y_0 = scaled y coordinate of pixel (scaled to lie in the Mandelbrot Y scale $(-1, 1)$) $x = 0.0$ $y = 0.0$ iteration = 0 max_iteration = 1000 while ($x*x + y*y < 2*2$ AND iteration < max_iteration) { $xtemp = x*x - y*y + x_0$ $y = 2*x*y + y_0$ $x = xtemp$ iteration = iteration + 1 } color = palette[iteration] plot(Px, Py, color) }

Here, relating the pseudocode to c , z and P_c :

- $z = x + iy$
- $z^2 = x^2 + i2xy - y^2$
- $c = x_0 + iy_0$

and so, as can be seen in the pseudocode in the computation of x and y :

- $x = \operatorname{Re}(z^2 + c) = x^2 - y^2 + x_0$ and $y = \operatorname{Im}(z^2 + c) = 2xy + y_0$.

To get colorful images of the set, the assignment of a color to each value of the number of executed iterations can be made using one of a variety of functions (linear, exponential, etc.). One practical way, without slowing down calculations, is to use the number of executed iterations as an entry to a look-up color palette table initialized at startup. If the color table has, for instance, 500 entries, then the color selection is $n \bmod 500$, where n is the number of iterations.

Histogram coloring

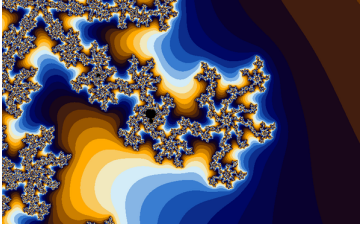
A more accurate coloring method involves using a **histogram**, which keeps track of how many pixels reached each iteration number, from 1 to n . This method will equally distribute colors to the same overall area, and, importantly, is independent of the maximal number of iterations chosen.

First, create an array of size n . For each pixel, which took i iterations, find the i th element and increment it. This creates the histogram during computation of the image. Then, when finished, perform a second “rendering” pass over each pixel, utilizing the completed histogram. If you had a continuous color palette ranging from 0 to 1, you could find the normalized color of each pixel as follows, using the variables from above.

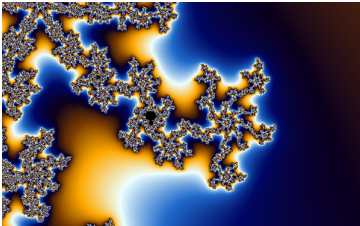
```
total = 0
for (i = 0; i < max_iterations; i += 1) { total += histogram[i] }
hue = 0.0
for (i = 0; i < iteration; i += 1) {
    hue += histogram[i] / total // Must be floating-point division.
}
color = palette[hue]
```

This method may be combined with the smooth coloring method below for more aesthetically pleasing images.

Continuous (smooth) coloring



This image was rendered with the escape time algorithm. There are very obvious “bands” of color



This image was rendered with the normalized iteration count algorithm. The bands of color have been replaced by a smooth gradient. Also, the colors take on the same pattern that would be observed if the escape time algorithm were used.

The escape time algorithm is popular for its simplicity. However, it creates bands of color, which, as a type of **aliasing**, can detract from an image's aesthetic value. This can be improved using an algorithm known as “normalized iteration count”^{[26][27]} which provides a smooth transition of colors between iterations. The algorithm associates a real number ν with each value of z by using the connection of the iteration number with the **potential function**. This function is given by

$$\phi(z) = \lim_{n \rightarrow \infty} (\log |z_n| / P^n),$$

where z_n is the value after n iterations and P is the power for which z is raised to in the Mandelbrot set equation ($z_{n+1} = z_n^P + c$, P is generally 2).

If we choose a large bailout radius N (e.g., 10^{100}), we have that

$$\log |z_n| / P^n = \log(N) / P^{\nu(z)}$$

for some real number $\nu(z)$, and this is

$$\nu(z) = n - \log_P(\log |z_n| / \log(N)),$$

and as n is the first iteration number such that $|z_n| > N$, the number we subtract from n is in the interval $[0, 1)$.

For the coloring we must have a cyclic scale of colors (constructed mathematically, for instance) and containing H colors numbered from 0 to $H - 1$ ($H = 500$, for instance). We multiply the real number $\nu(z)$ by a fixed real number determining the density of the colors in the picture, take the integral part of this number modulo H , and use it to look up the corresponding color in the color table.

For example, modifying the above pseudocode and also using the concept of **linear interpolation** would yield

```
For each pixel (Px, Py) on the screen, do: { x0 = scaled x coordinate of pixel (scaled to lie in the Mandelbrot X
scale (-2.5, 1)) y0 = scaled y coordinate of pixel (scaled to lie in the Mandelbrot Y scale (-1, 1)) x = 0.0 y = 0.0
iteration = 0 max_iteration = 1000 // Here N=2^8 is chosen as a reasonable bailout radius. while ( x*x + y*y < (1
<< 16) AND iteration < max_iteration ) { xtemp = x*x - y*y + x0 y = 2*x*y + y0 x = xtemp iteration = iteration
+ 1 } // Used to avoid floating point issues with points inside the set. if ( iteration < max_iteration ) { // sqrt of
inner term removed using log simplification rules. log_zn = log( x*x + y*y ) / 2 nu = log( log_zn / log(2) ) / log(2)
// Rearranging the potential function. // Dividing log_zn by log(2) instead of log(N = 1<<8) // because we want the
entire palette to range from the // center to radius 2, NOT our bailout radius. iteration = iteration + 1 - nu } color1
= palette[floor(iteration)] color2 = palette[floor(iteration) + 1] // iteration % 1 = fractional part of iteration. color =
linear_interpolate(color1, color2, iteration % 1) plot(Px, Py, color) }
```

26.8.2 Distance estimates

One can compute the **distance** from point c (in **exterior** or **interior**) to nearest point on the **boundary** of the Mandelbrot set. [28]

Exterior distance estimation

The proof of the **connectedness** of the Mandelbrot set in fact gives a formula for the **uniformizing map** of the **complement** of M (and the **derivative** of this map). By the **Koebe 1/4 theorem**, one can then estimate the distance between the midpoint of our **pixel** and the Mandelbrot set up to a factor of 4.

In other words, provided that the maximal number of iterations is sufficiently high, one obtains a picture of the Mandelbrot set with the following properties:

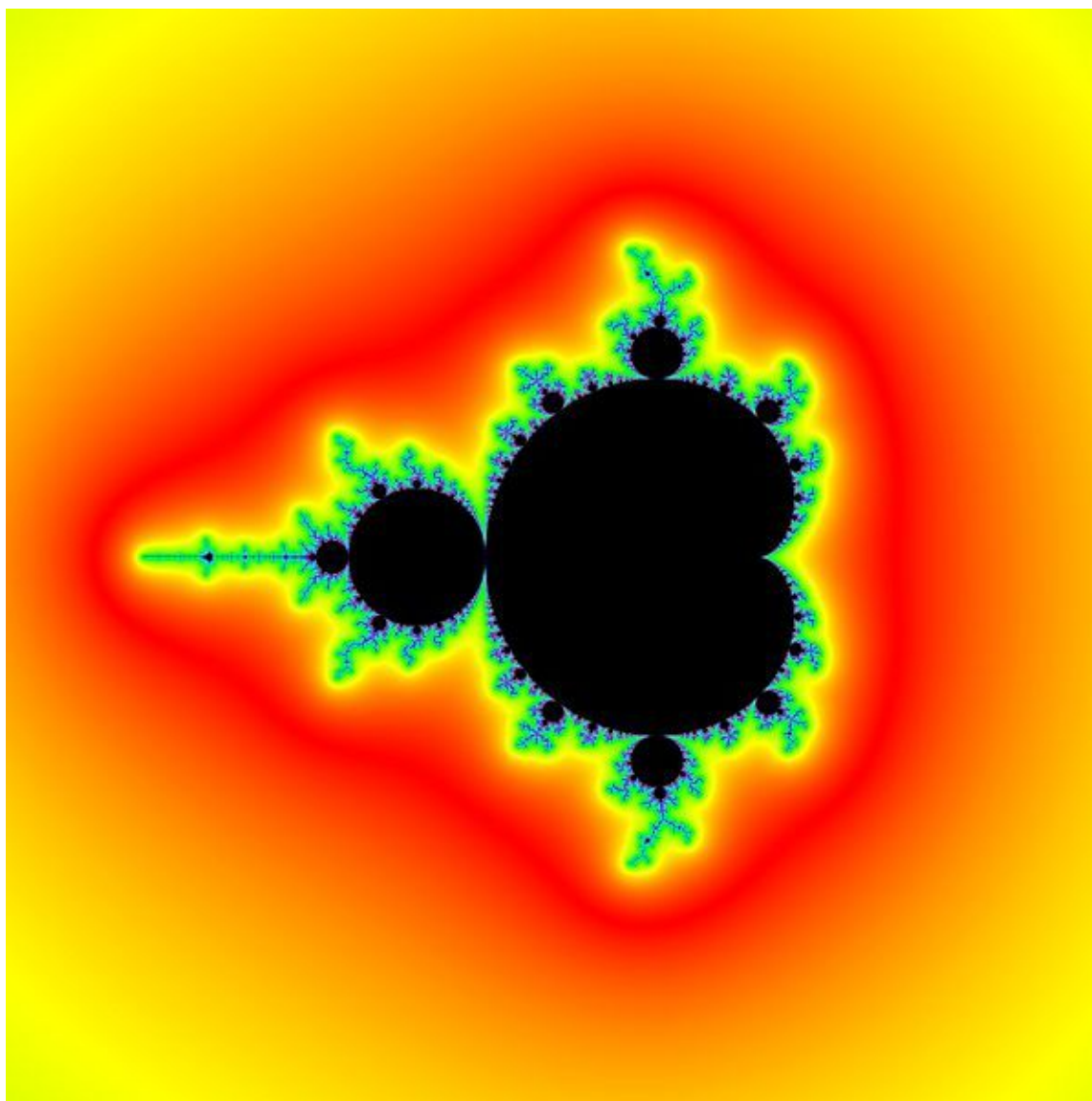
1. Every pixel that contains a point of the Mandelbrot set is colored black.
2. Every pixel that is colored black is close to the Mandelbrot set.

The distance estimate b of a pixel c (a complex number) from the Mandelbrot set is given by

$$b = \lim_{n \rightarrow \infty} 2 \cdot \frac{|P_c^n(c)| \cdot \ln |P_c^n(c)|}{\left| \frac{\partial}{\partial c} P_c^n(c) \right|},$$

where

- $P_c(z)$ stands for **complex quadratic polynomial**
- $P_c^n(c)$ stands for n iterations of $P_c(z) \rightarrow z$ or $z^2 + c \rightarrow z$, starting with $z = c$: $P_c^0(c) = c$, $P_c^{n+1}(c) = P_c^n(c)^2 + c$;



Exterior distance estimate may be used to color whole complement of Mandelbrot set

- $\frac{\partial}{\partial c} P_c^n(c)$ is the derivative of $P_c^n(c)$ with respect to c . This derivative can be found by starting with $\frac{\partial}{\partial c} P_c^0(c) = 1$ and then $\frac{\partial}{\partial c} P_c^{n+1}(c) = 2 \cdot P_c^n(c) \cdot \frac{\partial}{\partial c} P_c^n(c) + 1$. This can easily be verified by using the chain rule for the derivative.

The idea behind this formula is simple: When the equipotential lines for the potential function $\phi(z)$ lie close, the number $|\phi'(z)|$ is large, and conversely, therefore the equipotential lines for the function $\phi(z)/|\phi'(z)|$ should lie approximately regularly.

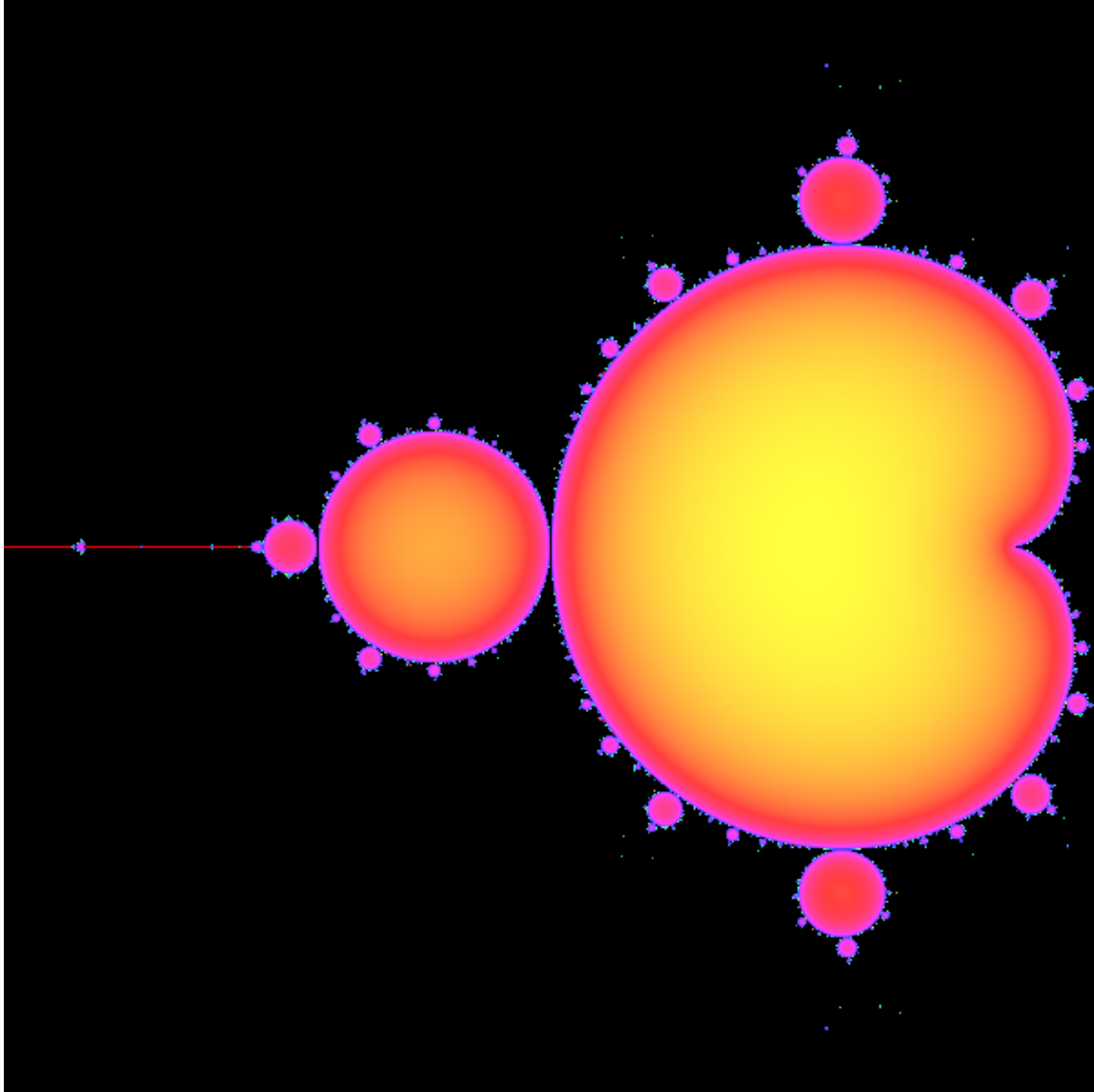
From a mathematician's point of view, this formula only works in limit where n goes to infinity, but very reasonable estimates can be found with just a few additional iterations after the main loop exits.

Once b is found, by the **Koebe 1/4-theorem**, we know there's no point of the Mandelbrot set with distance from c smaller than $b/4$.

The distance estimation can be used for drawing of the boundary of the Mandelbrot set, see the article **Julia set**.

Interior distance estimation

It is also possible to estimate the distance of a limitly periodic (i.e., inner) point to the boundary of the Mandelbrot set. The estimate is given by



Pixels colored according to the estimated interior distance

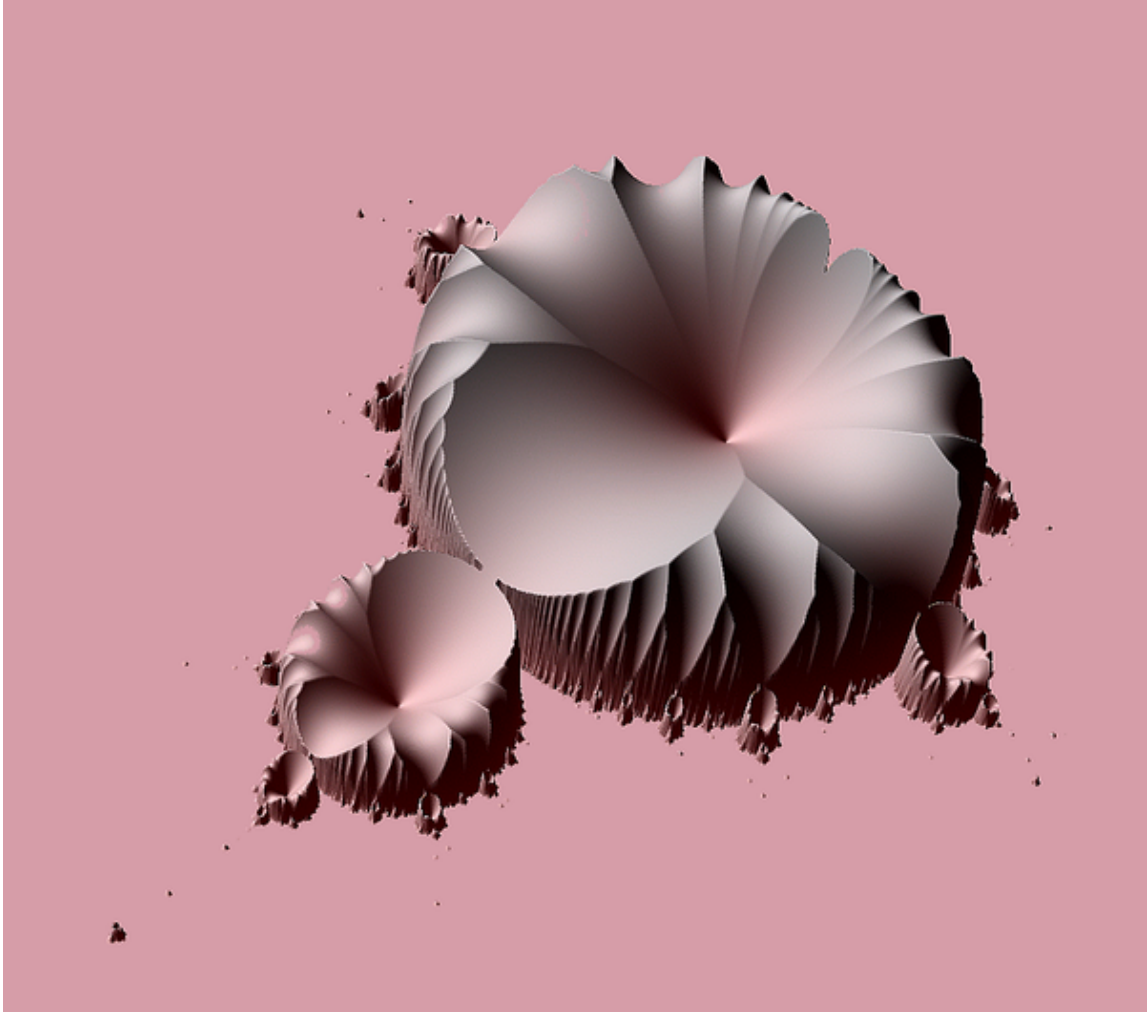
$$b = \frac{1 - \left| \frac{\partial}{\partial z} P_c^p(z_0) \right|^2}{\left| \frac{\partial}{\partial c} \frac{\partial}{\partial z} P_c^p(z_0) + \frac{\partial}{\partial z} \frac{\partial}{\partial z} P_c^p(z_0) \frac{\frac{\partial}{\partial c} P_c^p(z_0)}{1 - \frac{\partial}{\partial z} P_c^p(z_0)} \right|},$$

where

- p is the period,
- c is the point to be estimated,
- $P_c(z)$ is the complex quadratic polynomial $P_c(z) = z^2 + c$
- $P_c^p(z_0)$ is the p -fold iteration of $P_c(z) \rightarrow z$, starting with $P_c^0(z) = z_0$
- z_0 is any of the p points that make the attractor of the iterations of $P_c(z) \rightarrow z$ starting with $P_c^0(z) = c$; z_0 satisfies $z_0 = P_c^p(z_0)$,
- $\frac{\partial}{\partial c} \frac{\partial}{\partial z} P_c^p(z_0)$, $\frac{\partial}{\partial z} \frac{\partial}{\partial z} P_c^p(z_0)$, $\frac{\partial}{\partial c} P_c^p(z_0)$ and $\frac{\partial}{\partial z} P_c^p(z_0)$ are various derivatives of $P_c^p(z)$, evaluated at z_0 .

Analogous to the exterior case, once b is found, we know that all points within the distance of $b/4$ from c are inside the Mandelbrot set.

There are two practical problems with the interior distance estimate: first, we need to find z_0 precisely, and second, we need to find p precisely. The problem with z_0 is that the convergence to z_0 by iterating $P_c(z)$ requires, theoretically, an infinite number of operations. The problem with any given p is that, sometimes, due to rounding errors, a period is falsely identified to be an integer multiple of the real period (e.g., a period of 86 is detected, while the real period is only $43=86/2$). In such case, the distance is overestimated, i.e., the reported radius could contain points outside the Mandelbrot set.



3D view: smallest absolute value of the orbit of the interior points of the Mandelbrot set

26.8.3 Optimizations

Cardioid / bulb checking

One way to improve calculations is to find out beforehand whether the given point lies within the cardioid or in the period-2 bulb. Before passing the complex value through the escape time algorithm, first check that:

$$p = \sqrt{\left(x - \frac{1}{4}\right)^2 + y^2}$$

$$x < p - 2p^2 + \frac{1}{4}$$

$$(x + 1)^2 + y^2 < \frac{1}{16}$$

where x represents the real value of the point and y the imaginary value. The first two equations determine that the point is within the cardioid, the last the period-2 bulb.

The cardioid test can equivalently be performed without the square root:

$$q = \left(x - \frac{1}{4}\right)^2 + y^2,$$

$$q \left(q + \left(x - \frac{1}{4}\right) \right) < \frac{1}{4}y^2.$$

3rd- and higher-order buds do not have equivalent tests, because they are not perfectly circular.*[29] However, it is possible to find whether the points are within circles inscribed within these higher-order bulbs, preventing many, though not all, of the points in the bulb from being iterated.

Periodicity checking

To prevent having to do huge numbers of iterations for points in the set, one can perform periodicity checking. Check whether a point reached in iterating a pixel has been reached before. If so, the pixel cannot diverge and must be in the set.

Periodicity checking is, of course, a trade-off. The need to remember points costs memory and *data management* instructions, whereas it saves *computational* instructions.

However, checking against only one previous iteration can detect many periods with little performance overhead. For example, within the while loop of the pseudocode above, make the following modifications.

```
while (x*x + y*y < 2*2 AND iteration < max_iteration) { xtemp = x*x - y*y + x0 ytemp = 2*x*y + y0 if (x == xtemp AND y == ytemp) { iteration = max_iteration break } x = xtemp y = ytemp iteration = iteration + 1 }
```

Border tracing / edge checking

It can be shown that if a solid shape can be drawn on the Mandelbrot set, with all the border colors being the same, then the shape can be filled in with that color. This is a result of the Mandelbrot set being simply connected. Boundary tracing works by following the *lemniscates* of the various iteration levels (colored bands) all around the set, and then filling the entire band at once. This can be a good speed increase, because it means that large numbers of points can be skipped.*[30]

A similar method operating on the same principle uses rectangles instead of arbitrary border shapes. It is usually faster than boundary tracing because it requires fewer calculations to work out the rectangle. It is inefficient, however, because boundaries are not rectangular, and so some areas can be missed. This issue can be minimized by creating a recursive algorithm that, if a rectangle border fails, will subdivide it into four smaller rectangles and test those, and either fill each or subdivide again and repeat the process.

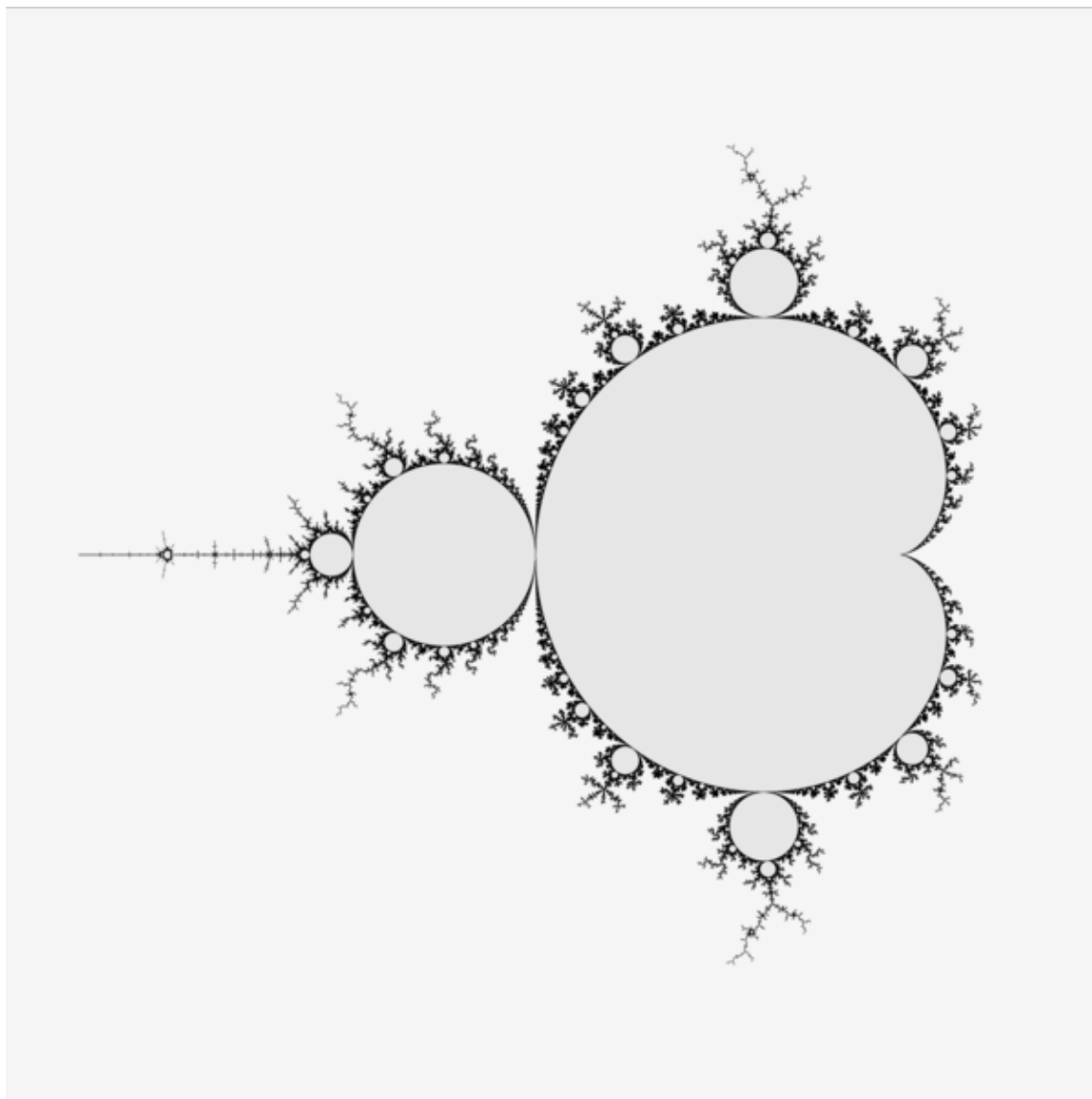
However, this only works using discrete colors in the escape time algorithm. It will not work for smooth/continuous coloring.

Perturbation theory and series approximation

Very highly magnified images require more than the standard 64–128 or so bits of precision that most hardware floating-point units provide, requiring renderers to use slow “bignum” or “arbitrary-precision” math libraries to calculate. However, this can be sped up by the exploitation of *perturbation theory*. Given

$$z_{n+1} = z_n^2 + c$$

as the iteration, and a small epsilon, it is the case that



Edge detection using Sobel filter of hyperbolic components of Mandelbrot set

$$(z_n + \epsilon)^2 + c = z_n^2 + 2z_n\epsilon + \epsilon^2 + c,$$

or

$$z_{n+1} = 2z_n\epsilon + \epsilon^2,$$

so if one defines

$$\epsilon_{n+1} = 2z_n\epsilon_n + \epsilon_n^2,$$

one can calculate a single point (e.g. the center of an image) using high-precision arithmetic (z), giving a *reference orbit*, and then compute many points around it in terms of various initial offsets epsilon-zero plus the above iteration for epsilon. For most iterations, epsilon does not need more than 16 significant figures, and consequently hardware floating-point may be used to get a mostly accurate image.* [31] There will often be some areas where the orbits of points diverge enough from the reference orbit that extra precision is needed on those points, or else additional local high-precision-calculated reference orbits are needed. By measuring the orbit distance between the reference point

and the point calculated with low precision, it can be detected that it is not possible to calculate the point correctly, and the calculation can be stopped. These incorrect points can later be re-calculated e.g. from another closer reference point.

Further, it is possible to approximate the starting values for the low-precision points with a truncated **Taylor series**, which often enables a significant amount of iterations to be skipped.*[32] Renderers implementing these techniques are **publicly available** and offer speedups for highly magnified images by around two orders of magnitude.*[33]

26.9 References in popular culture

- The **Jonathan Coulton** song “Mandelbrot Set” is a tribute to both the fractal itself and to its father Benoit Mandelbrot.*[34]
- The second book of the *Mode series* by **Piers Anthony**, *Fractal Mode*, describes a world that is a perfect 3D model of the set.*[35]
- The **Arthur C. Clarke** novel *The Ghost from the Grand Banks* features an artificial lake made to replicate the shape of the Mandelbrot set.*[36]
- The South Korean heavy metal singer **Norazo** made a music video *Ni pal za ya* (your fortune), which starts with hypnotic video including Mandelbrot set.*[37]
- The album *Jupiters Darling* by American rock band **Heart** prominently features a Mandelbrot set on the cover. The set is rotated so that the cusp is on the top, resembling a heart.

26.10 See also

- Collatz fractal
- **Gilbreath permutation**, a combinatorial object that can be used to count the real periodic points of the Mandelbrot set
- Julia set
- Mandelbox
- Mandelbulb
- Newton fractal
- Orbit portrait
- Orbit trap
- Pickover stalk

26.11 References

- [1] Adrien Douady and John H. Hubbard, *Etude dynamique des polynômes complexes*, Prépublications mathématiques d'Orsay 2/4 (1984 / 1985)
- [2] Robert Brooks and Peter Matelski, *The dynamics of 2-generator subgroups of $PSL(2, C)$* , in Irwin Kra (1 May 1981). Irwin Kra, ed. *Riemann Surfaces and Related Topics: Proceedings of the 1978 Stony Brook Conference*. Bernard Maskit. Princeton University Press. pp. 65–. ISBN 0-691-08267-7.
- [3] R.P. Taylor & J.C. Sprott (2008). “Biophilic Fractals and the Visual Journey of Organic Screen-savers” (pdf). *Nonlinear Dynamics, Psychology, and Life Sciences, Vol. 12, No. 1*. Society for Chaos Theory in Psychology & Life Sciences. Retrieved 1 January 2009.
- [4] Benoit Mandelbrot, *Fractal aspects of the iteration of $z \mapsto \lambda z(1 - z)$ for complex λ, z* , *Annals of the New York Academy of Sciences* **357**, 249/259

- [5] Peitgen, Heinz-Otto; Richter Peter (1986). *The Beauty of Fractals*. Heidelberg: Springer-Verlag. ISBN 0-387-15851-0.
- [6] *Frontiers of Chaos*, Exhibition of the Goethe-Institut by H.O. Peitgen, P. Richter, H. Jürgens, M. Prüfer, D.Saupe. since 1985 shown in over 40 countries.
- [7] Gleick, James (1987). *Chaos: Making a New Science*. London: Cardinal. p. 229.
- [8] Dewdney, A. K. (1985). *A computer microscope zooms in for a close look at the most complicated object in mathematics*. <http://www.nature.com/scientificamerican/journal/v253/n2/pdf/scientificamerican0885-16.pdf>: Scientific American. pp. 16–24. (subscription required)
- [9] John Briggs (1992). *Fractals: The Patterns of Chaos*. p. 80.
- [10] Pountain, Dick (September 1986). “Turbocharging Mandelbrot” . *Byte*. Retrieved 11 November 2015.
- [11] Lyubich, Mikhail (May–June 1999). “Six Lectures on Real and Complex Dynamics” (PDF). Retrieved 2007-04-04.
- [12] Lyubich, Mikhail (November 1998). “Regular and stochastic dynamics in the real quadratic family” (PDF). *Proceedings of the National Academy of Sciences of the United States of America*. **95** (24): 14025–14027. doi:10.1073/pnas.95.24.14025. PMC 24319 . PMID 9826646. Retrieved 2007-04-04.
- [13] “Mandelbrot Set Explorer: Mathematical Glossary” . Retrieved 2007-10-07.
- [14] “Escape Radius, Mu-Ency at MROB” . Retrieved 2015-10-21.
- [15] Numerical estimation of the area of the Mandelbrot set (2012)
- [16] *The Mandelbrot set, theme and variations*. Tan, Lei. Cambridge University Press, 2000. ISBN 978-0-521-77476-5. Section 2.1, “Yoccoz para-puzzles” , p. 121
- [17] *Exploring the Mandelbrot set. The Orsay Notes* by Adrien Douady and John H. Hubbard. page 12
- [18] Wolf Jung, March 2002, Homeomorphisms on Edges of the Mandelbrot Set by Wolf Jung
- [19] Hubbard, J. H. (1993), “Local connectivity of Julia sets and bifurcation loci: three theorems of J.-C. Yoccoz” (PDF), *Topological methods in modern mathematics (Stony Brook, NY, 1991)*, Houston, TX: Publish or Perish, pp. 467–511, MR 1215974. Hubbard cites as his source a 1989 unpublished manuscript of Yoccoz.
- [20] Lei.pdf Tan Lei, “Similarity between the Mandelbrot set and Julia Sets” , *Communications in Mathematical Physics* 134 (1990), pp. 587-617.
- [21] J. Milnor (1989). “Self-Similarity and Hairiness in the Mandelbrot Set” . In M. C. Tangora. *Computers in Geometry and Topology*. New York: Taylor & Francis. pp. 211–257.)
- [22] Shishikura, Mitsuhiro (1998), “The Hausdorff dimension of the boundary of the Mandelbrot set and Julia sets” , *Annals of Mathematics*, Second Series, **147** (2): 225–267, arXiv:math.DS/9201282 , doi:10.2307/121009, MR 1626737.
- [23] Klebanoff, Aaron (2001), “ π in the Madelbrot set” (PDF), *Fractals*, **9** (4): 393–402, doi:10.1142/S0218348X01000828, MR 1878044, archived from the original (PDF) on 6 April 2012
- [24] Gary William Flake, *The Computational Beauty of Nature*, 1998. p. 125. ISBN 978-0-262-56127-3.
- [25] Rudy Rucker's discussion of the CCM: CS.sjsu.edu
- [26] García, Francisco; Ángel Fernández; Javier Barrallo; Luis Martín. “Coloring Dynamical Systems in the Complex Plane” (PDF). Retrieved 2008-01-21.
- [27] Linas Vepstas. “Renormalizing the Mandelbrot Escape” .
- [28] Albert Lobo Cusidó. “Interior and exterior distance bounds for the Mandelbrot” .
- [29] “Mandelbrot Bud Maths” .
- [30] “Boundary Tracing Method” . Archived from the original on 2015-02-20.
- [31] “Superfractalthing - Arbitrary Precision Mandelbrot Set Rendering in Java” .
- [32] K. I. Martin. “Superfractalthing Maths” (PDF).
- [33] “Kalles Fraktaler 2” .
- [34] “Mandelbrot Set” . *JoCopeda*. Retrieved 15 January 2015.

- [35] Piers Anthony (1992). *Fractal Mode*. HarperCollins. ISBN 978-0-246-13902-3.
- [36] Arthur C. Clarke (29 September 2011). *The Ghost From The Grand Banks*. Orion. ISBN 978-0-575-12179-9.
- [37] "NORAZO " मङ्गलबेथ " मङ्गल M/V / Ni pal ja ya (your fortune)" (video). *YouTube*. Published in February 22, 2015 by NORAZO PRODUCTION.

26.12 Further reading

- John W. Milnor, *Dynamics in One Complex Variable* (Third Edition), Annals of Mathematics Studies 160, (Princeton University Press, 2006), ISBN 0-691-12488-4
(First appeared in 1990 as a Stony Brook IMS Preprint, available as arXiv:math.DS/9201272)
- Nigel Lesmoir-Gordon, *The Colours of Infinity: The Beauty, The Power and the Sense of Fractals*, ISBN 1-904555-05-5
(includes a DVD featuring Arthur C. Clarke and David Gilmour)
- Heinz-Otto Peitgen, Hartmut Jürgens, Dietmar Saupe, *Chaos and Fractals: New Frontiers of Science* (Springer, New York, 1992, 2004), ISBN 0-387-20229-3

26.13 External links

- Chaos and Fractals at DMOZ
- The Mandelbrot Set and Julia Sets by Michael Frame, Benoit Mandelbrot, and Nial Neger
- Video: Mandelbrot fractal zoom to 6.066 e228
- मण्डलबेथ (maṇḍalabeth) 3D analog of the mandelbrot set, with various symmetry groups
- Relatively simple explanation of the mathematical process, by Dr Holly Krieger, MIT
- Mandelbrot set images online rendering

Chapter 27

Marocchinate



Moroccan soldiers at Monte Cassino, January 1944

Marocchinate (pronounced [marokki'nate], Italian for “those given the Moroccan treatment” meaning “women raped by Moroccans”) is a term applied to women who were victims of the mass **rape** and killings committed during World War II after the **Battle of Monte Cassino** in Italy. These were committed mainly by the Moroccan Goumiers, colonial troops of the **French Expeditionary Corps (FEC)**,* [1] commanded by General **Alphonse Juin**.

The monument “**Mamma Ciociara**” was erected in remembrance of the Marocchinate women, particularly those who were killed during the military campaign.

27.1 Background

Goumiers were colonial irregular troops forming the “Goums Marocains” , which were approximately company-sized units rather loosely grouped in “Tabors” (battalions) and Groups (regiments). Three of these units (the 1st, 3rd, 4th Groupements de Tabors) served in the FEC along with the four regular divisions: the 1st Free French Division, the 2nd Moroccan Infantry Division, the 3rd Algerian Infantry Division and the 4th Moroccan Mountain Division. The French: *Goums Marocains* were commanded by General Augustin Guillaume.

On May 14, 1944, the Goumiers travelled over seemingly impassable terrain in the Aurunci Mountains, outflanked the German defence in the adjacent Liri valley, materially assisting the British XIII Corps of the British Eighth Army, to break the Gustav Line and advance to the next Wehrmacht prepared defensive position, the Hitler Line.

An alleged statement by General Alphonse Juin before the battle said: “For fifty hours you will be the absolute masters of what you will find beyond the enemy. Nobody will punish you for what you will do, nobody will ask you about what you will get up to.” * [2] Recent research has showed this statement was forged after the war by Italian victims' associations and is linked to the perception of the crimes by the Italians rather than an official policy of the French Army. * [3]

27.2 Mass rape

Monte Cassino was captured by the Allies on May 18, 1944. The next night, thousands of Goumiers and other colonial troops scoured the slopes of the hills surrounding the town and the villages of Ciociaria (in South Latium). Italian victims' associations such as Associazione Nazionale Vittime delle Marocchine alleged that 60,000 women, ranging in age from 11 to 86, suffered from violence, when village after village came under control of the Goumiers. Civilian men who tried to protect their wives and daughters were murdered. The number of men killed has been estimated at 800. * [4] In fact, due to incomplete reports of the crimes, a precise account is impossible. * [5]

The mayor of Esperia, a comune in the Province of Frosinone, reported that in his town, 700 women out of 2,500 inhabitants were raped resulting in many deaths. According to Italian victims associations, a total of more than 7,000 civilians, including children, were raped by Goumiers. * [6]

27.3 Cultural depictions

In Castro dei Volsci, a monument called the “Mamma Ciociara” now stands to remember all the mothers who tried in vain to defend themselves and their daughters. * [7] * [8]

In 1957, the Italian writer Alberto Moravia wrote the novel *La Ciociara* based on the mass rape. It is the drama of a mother and her daughter, both raped by the Goumiers. The novel was made into a movie, *Two Women*, directed by Vittorio de Sica and starring Sophia Loren, for which Loren won the Academy Award for Best Actress, the first time it was awarded for a non-English-speaking role.

27.4 Criticism

However, other sources including the French Marshal Jean de Lattre de Tassigny declare that such cases were isolated events that were used by German propaganda to smear allies and in particular French troops. * [9] Regular Moroccan troops (*tirailleurs Marocain*) also served in Italy, but under tighter discipline and with a higher proportion of officers than the irregular goumiers.

27.5 Notes

[1] French: *Corps Expéditionnaire Français (CEF)* or *Corps Expéditionnaire Français en Italie (CEFI)*

[2] “Crimini di Guerra in Ciociaria” [War Crimes in Ciociaria]. *Dal Volturno a Cassino* (in Italian).

[3] Baris, Tommaso. “Le corps expéditionnaire français en Italie – Violences des “libérateurs” durant l’ été 1944” [The French Expeditionary Corps in Italy – Violence of the “liberators” during the summer of 1944] (in French).

- [4] “Seduta Notturna Di Lunedì 7 Aprile 1952” [Sitting by Night: Monday, August 7, 1952] (PDF) (in Italian). Chamber of Deputies.
- [5] Baris, Tommaso. “Le corps expéditionnaire français en Italie – Violences des “libérateurs” durant l’été 1944” [The French Expeditionary Corps in Italy – Violence of the “liberators” during the summer of 1944] (in French).
- [6] “1952: Il caso delle “marocchine” al Parlamento” (in Italian). Retrieved 2008-11-22.
- [7] (Italian) Mamma Ciociara
- [8] (Italian) La Mamma Ciociara
- [9] Jean de Lattre de Tassigny, *Reconquérir: 1944-1945. Textes du maréchal Lattre de Tassigny réunis et présentés par Jean-Luc Barre*, éditions Plon, 1985, p. 32-33

27.6 References

- Baris, Tommaso. “Le corps expéditionnaire français en Italie – Violences des “libérateurs” durant l’été 1944” [The French Expeditionary Corps in Italy – Violence of the “liberators” during the summer of 1944] (in French).
- Baris, Tommaso (2004). *Tra due fuochi: Esperienza e memoria della guerra lungo la linea Gustav* (in Italian). Laterza. ISBN 978-88-420-7108-2.
- Bimberg, Edward L. “Augustin-Leon Guillaume's Goums in a Modern War”. Weider History Group. Archived from the original on 2007-09-30. It praises the fighting ability in difficult terrain and “Unfortunately for the Goumiers, their military success did not prevent their fearsome reputation from taking its toll as exceptional numbers of Moroccans were executed—many without trial—for allegedly murdering, raping, and pillaging their way across the Italian countryside.”
- (French) Comments about the mass rape in Ciociaria, with video from Two Women (the rape by the goumiers)
- De Luna, Giovanni. “La ciociara e le altre” [*La Ciociara* and the others] (in Italian). Archived from the original on 2009-01-13.
- Frezza, Daria. “Cassino 1943–44: La memoria” (PDF) (in Italian).
- Holland, James (2008). *Italy's Sorrow – A year of war, 1944–45*. London: Harper Press. ISBN 978-0-00-717645-8.
- “I marocchini di Juin “riscattano” l'onore della Francia” [Juin's Moroccans “redeem” the honour of Free France]. *Dal Volturmo a Cassino* (in Italian).
- Johnston, Bruce (11 May 1997). “Italian women win cash for wartime rapes” . *International News Electronic Telegraph*.
- “Le Marocchine” (in Italian). Istituto tecnico Luca Pacioli Crema. Archived from the original on 2006-05-15.
- No War. “Lo stupro di massa degli alleati” [The mass rape of the Allies] (in Italian). Archived from the original on 2011-07-09.
- Peterson, Allan (1998). “Pizza Man's Atrocity Hunt” . *San Diego Reader*. (Anecdotal allegations of war crimes committed by Goumiers in Italy)
- “Senate of the Italian Republic: project of law for the victims of war rapes” (PDF) (in Italian). July 25, 1996.
- Weisbord, Robert G.; Honhart, Michael W (Winter 2002). “A Question of Race: Pope Pius XII and the “Coloured Troops” in Italy” . *The Historian*. **65** (2): 403–417. doi:10.1111/1540-6563.00026.

27.7 External links

- [Association National Victims of the Goumiers](#)
- [La verità nascosta delle “marocchine” , saccheggi e stupri delle truppe francesi in mezza Italia, La Stampa](#)
- [Two Women \(*La Ciociara*\) at the Internet Movie Database.](#)

Chapter 28

Mayflower

For other ships, see [Mayflower \(ship\)](#). For other uses, see [Mayflower \(disambiguation\)](#).

The *Mayflower* was the ship that transported the first [English Separatists](#), known today as the [Pilgrims](#), from [Plymouth, England](#) to the [New World](#) in 1620. ^[1]^[2] There were 102 passengers, and the crew is estimated to have been about 30, but the exact number is unknown. ^[3] This voyage has become an iconic story in some of the earliest annals of [American history](#), with its story of death and of survival in the harsh [New England](#) winter environment. The culmination of the voyage in the signing of the [Mayflower Compact](#) was an event which established a rudimentary form of democracy, with each member contributing to the welfare of the community. ^[4] There was a second ship named *Mayflower* that made the [London to Plymouth, Massachusetts](#) voyage several times.

28.1 *Mayflower* structure and layout

The Pilgrim ship *Mayflower* was a typical English merchant ship of the early 17th century, [square-rigged](#) and [beak-bowed](#) with high, castle-like structures [fore](#) and [aft](#) that served to protect the ship's crew and the main deck from the elements. Her stern carried a 30-foot high, square aft-castle which made the ship extremely difficult to sail against the wind and unable to sail well against the North Atlantic's prevailing [Westerlies](#), especially in the Fall and Winter of 1620. This was the direct cause of the voyage from England to America taking more than two months. The *Mayflower's* return trip to London in April–May 1621 took less than half that time, with the same strong winds following. ^[5]^[6]

By 1620, the *Mayflower* was aging, nearing the end of the usual working life of an English merchant ship in that era, some 15 years. No dimensions of her hull can be stated exactly, since this was many years before such measurements were standardized. She probably measured about 100 feet (30 m) in length from the forward end at the beak of her prow to the tip of her stern superstructure aft. She was about 25 feet (7.6 m) at her widest point, with the bottom of her keel about 12 feet (3.6 m) below the waterline. Although [William Bradford](#) was not a mariner, he estimated that *Mayflower* had a cargo capacity of 180 tons. What is known on the basis of surviving records from that time is that she could certainly accommodate 180 casks of wine in her cargo hold. The casks were great barrels that each held hundreds of gallons of [claret wine](#). ^[6]

This was a ship that traditionally was heavily armed while on trading routes around Europe, due to the possibility of encountering [pirates](#) and [privateers](#) of all types. And with its armament, the ship and crew could easily be conscripted by the English monarch at any time in case of conflict with other nations. ^[7]

28.1.1 General layout

The general layout of the ship was as follows:

- Three [masts](#): mizzen (aft), main (midship), and fore, and also a [spritsail](#) in the bow area. ^[8]
- Three primary levels: main deck, gun deck, and cargo hold.

Main deck

Aft on the main deck in the stern was the cabin for Master **Christopher Jones**, measuring about ten by seven feet (3 m × 2.1 m). Forward of that was the steerage room, which housed a **whipstaff** (tiller extension) for sailing control; not a wheel, as in later ships. Also here was the ship's **compass** and probably also berths for the ship's officers. Forward of the steerage room was the **capstan**, a vertical axle used to pull in ropes or cables. Far forward on the main deck, just aft of the bow, was the forecastle space where the ship's cook prepared meals for the crew; it may also have been where the ship's sailors slept.*[7]

The **poop deck** was above the cabin of Master Jones, on the ship's highest level above the stern on the aft castle. The poop house was on this deck, which may have been for passengers' use either for sleeping or cargo. On normal merchant ships, this space was probably a chart room or a cabin for the master's mates.*[9]*[10]

Gun deck

The gun deck was where the passengers resided during the voyage, in a space measuring about 50 by 25 feet (15.2 m × 7.6 m) with a five-foot (1.5 m) overhead (ceiling). But it was also a dangerous place in conflict, as it had port and starboard **gun ports** from which **cannon** could be run out to fire on the enemy. The gun room was in the stern area of the gun deck, to which passengers had no access due to it being the storage space for powder and ammunition for the ship's cannons and any other weapons belonging to the ship. The **gun room** might also house a pair of **stern chasers**, small cannons used to fire out the stern of the ship. Forward on the gun deck in the bow area was a windlass, equipment similar in function to the capstan in steerage, which was used to raise and lower the ship's main **anchor**. There were no stairs for the passengers on the gun deck to go up through the gratings to the main deck. To get up to the main deck, passengers were required to climb a wooden or rope ladder.*[9]*[10]

There was no facility for a latrine or privy on the *Mayflower*, and ship's crew had to fend for themselves in that regard. Gun deck passengers most likely used a bucket as a **chamber pot**, affixed to the deck or bulkhead to keep it from being jostled at sea.*[10]*[11]

Gun deck armament

The largest gun was a **minion cannon** which was brass, weighed about 1,200 pounds (545 kg), and could shoot a 3.5 pound (1.6 kg) **cannonball** almost a mile (1,600 m). The *Mayflower* also had on board a **saker cannon** of about 800 pounds (360 kg), and two base cannons that weighed about 200 pounds (90 kg) which shot a 3 to 5 ounce ball (85–140 g). She carried at least ten pieces of ordnance on the port and starboard sides of her gun deck: seven cannons for long range purposes, and three smaller guns often fired from the stern at close quarters that were filled with musket balls. Later at New Plymouth, *Mayflower* Master Jones unloaded four of the pieces to help fortify the colony against invaders, and would not have done so unless he was comfortable with the armament that he still had on board.*[6]

Cargo hold

Below the gun deck was the cargo hold where the passengers kept most of their food stores and other supplies. Other items included most of their clothing and bedding. The hold also stored the passengers' personal weapons and military equipment – armor, muskets, gunpowder, and shot, as well as swords and bandoliers. It also stored all the tools that the Pilgrims would need, as well as all the equipment and utensils needed to prepare meals in the New World. It is also known that some Pilgrims loaded trade goods on board, including **Isaac Allerton**, **William Mullins**, and possibly others; these also most likely were stored in the cargo hold.*[11]

28.2 Early history

It is not known when and where the *Mayflower* was built, but it is likely that she was launched at **Harwich** in the county of **Essex**, England. She was designated as “of Harwich” in the Port Books of 1609–11, although later known as “of **London**”. Harwich was also the birthplace of *Mayflower* master **Christopher Jones** about 1570.*[12]

Captain Jones became master of the *Mayflower* 11 years prior to the Pilgrims' voyage, sailing the ship cross-Channel taking English woolens to France and bringing French wine to London. In addition, he had also transported hats, hemp, Spanish salt, hops, and vinegar to Norway, and may have taken the *Mayflower* whaling in the North Atlantic

in the Greenland area. She had traveled to **Mediterranean** ports, being then owned by Christopher Nichols, Robert Child, Thomas Short, and Christopher Jones, the ship's **master**. In 1620, Jones and Robert Child still owned their quarter shares in the ship, and it was from them that **Thomas Weston** chartered her in the summer of 1620 to undertake the Pilgrim voyage. Weston had a significant role in the *Mayflower* voyage, due to his membership in the **Company of Merchant Adventurers**, and he eventually traveled to the **Plymouth Colony** himself. * [5] * [13] * [14]

There were 26 vessels bearing the same name as the Pilgrim ship in the Port Books of England in the reign of **James I** (1603–1625), and the reason for this popularity of the name has never been found. * [15] One particular *Mayflower* that has caused historical confusion is a *Mayflower* erroneously identified as one of the 1620 Pilgrims. This ship was partly owned by **John Vassall** and was outfitted for **Queen Elizabeth** in 1588, during the time of the **Spanish Armada**, a war for which Vassall outfitted several ships. However, there are no records of Vassall's *Mayflower* after 1594. * [16] The identity of Captain Jones's *Mayflower* is based on records of the time of her home port, her **tonnage** (est. 180–200 tons), and the master's name in 1620 in order to avoid confusion with the many other *Mayflower* ships. * [15]

Records dating from August 1609 first note Christopher Jones as master and part owner of the *Mayflower* when his ship was chartered for a voyage from London to **Trondheim** in **Norway** and back to **London**. The ship lost an anchor on her return, due to bad weather, and made short delivery of her cargo of herrings. Litigation resulted, and this was still proceeding in 1612.

Christopher Jones is described in a document of January 1611 as being “of Harwich” , and his ship is called the *Mayflower* of Harwich (in the county of **Essex**). Records of Jones's ship *Mayflower* show that the ship was twice on the Thames at London in 1613, once in July and again in October and November. Records of 1616 again state that Jones's ship was on the Thames, carrying a cargo of wine, which suggests that the ship had recently been on a voyage to France, Spain, Portugal, the Canaries, or some other wine-producing land.

After 1616, there is no further record which specifically relates to Jones's *Mayflower* until 1624. This is unusual for a ship trading to London, as it would not usually disappear from the records for such a long time. And no **Admiralty court** document can be found relating to the pilgrim fathers' voyage of 1620, although this might be due to the unusual way in which the transfer of the pilgrims was arranged from **Leyden** to New England. Or some of the records of the period may have been lost.

28.3 Voyage

28.3.1 *Speedwell* and *Mayflower*

About 65 passengers embarked the *Mayflower* in London at its homeport in the **Rotherhithe** district on the Thames about the middle of July in 1620. She then proceeded down the Thames into the **English Channel** and then on to the south coast to anchor at Southampton Water. The *Mayflower* waited there for seven days for a rendezvous on July 22 with the *Speedwell*, coming with Leiden church members from **Delfshaven** in Holland.

The two ships set sail about August 5, but the unseaworthy *Speedwell* sprang a leak shortly after, and the ships were put into Dartmouth for repairs. The two ships made a new start after the repairs, and they were more than 200 miles (320 km) beyond Land's End at the southwestern tip of England when *Speedwell* sprang another leak. It was now early September, and they had no choice but to abandon the *Speedwell* and make a determination on her passengers. This was a dire event, as the ship had wasted vital funds and was considered very important to the future success of their settlement in America. *Speedwell* was sold soon after the *Mayflower* continued on her voyage to America. According to Bradford, she was refitted and “made many voyages... to the great profit of her owners.” Bradford later assumed that *Speedwell* master Reynolds's “cunning and deceit” (in causing what may have been man-made leaks in the ship) had been motivated by a fear of starving to death in America. * [17]

In addition to the 102 passengers, the officers and crew consisted of about 25–30 persons, bringing the total persons on board the *Mayflower* to approximately 130. * [18]

28.3.2 *Mayflower* sets sail

In early September, western gales begin to make the North Atlantic a dangerous place for sailing. The *Mayflower's* provisions were already quite low when departing Southampton, and they became lower still by delays of more than a month. The passengers had been on board the ship for this entire time, and they were quite worn out and in no condition for a very taxing, lengthy Atlantic journey cooped up in cramped spaces in a small ship. But the *Mayflower*



Mayflower arrived in the “Cape Cod fishhook” , 11 November 1620 (satellite photo, 1997)

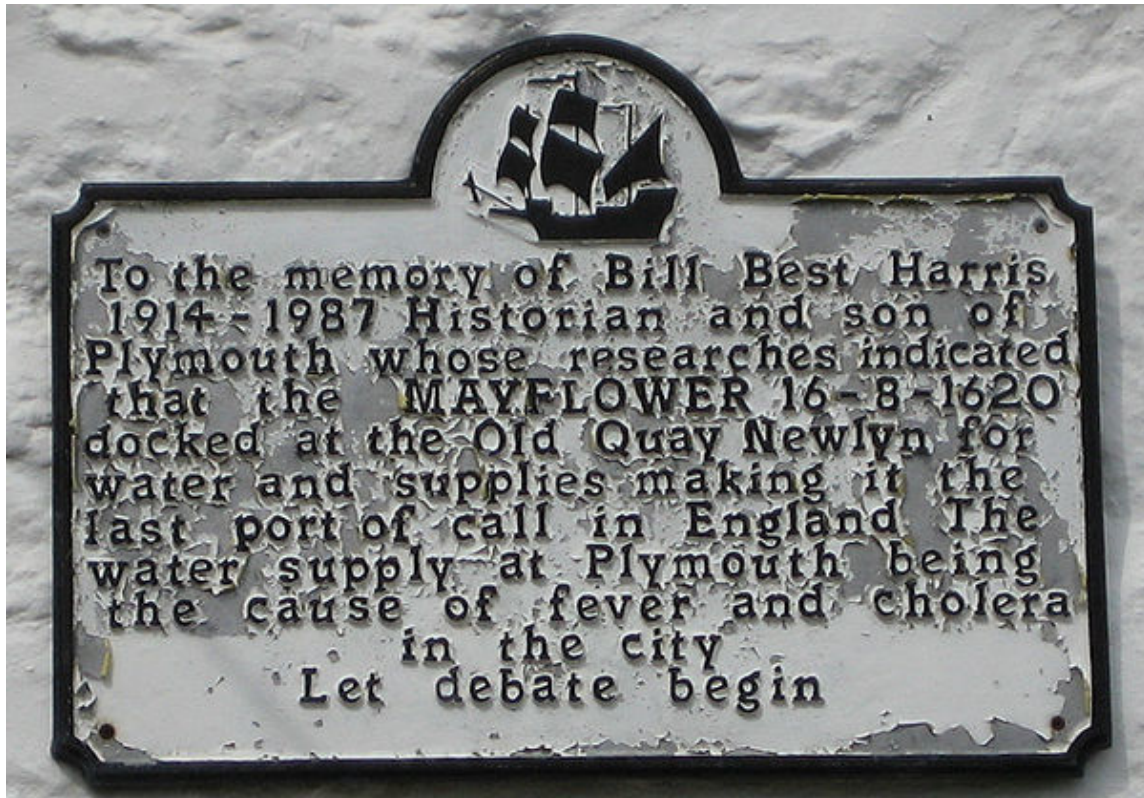
sailed from Plymouth on September 6, 1620 with what Bradford called “a prosperous wind” .*[19]

The last port in England for the *Mayflower* was traditionally thought to be **Plymouth**; however, there is continued controversy that the ship had to stop at **Newlyn** in Cornwall on the Land's End peninsula before sailing west. It was believed that the water picked up at Plymouth had caused **fever** and **cholera** in the city, so Newlyn provided fresh water to the ship. Newlyn has a plaque to this effect on the side of a building on its quay, erected in remembrance of Plymouth historian **Bill Best Harris**, whose research is believed to have uncovered this little-known detail about the voyage.*[20]*[21]

Aboard the *Mayflower* were many stores that supplied the pilgrims with the essentials needed for their journey and future lives. It is assumed that they carried tools and weapons, including cannon, shot, and gunpowder, as well as some live animals, including dogs, sheep, goats, and poultry. Horses and cattle came later. The *Mayflower* also carried two boats: a long boat and a “shallop”, a 21-foot boat powered by oars or sails. She also carried 12 artillery pieces (eight **minions** and four **sakers**), as the Pilgrims feared that they might need to defend themselves against enemy European forces, as well as the natives.*[22]

For more details on acquisition of the ship and the planning of the voyage, see **Pilgrims (Plymouth Colony)**.

The passage was a miserable one, with huge waves constantly crashing against the ship's topside deck until a key structural support timber fractured. The passengers had already suffered agonizing delays, shortages of food, and



Plaque on the side of a building next to Newlyn Old Quay

other shortages, and were now called upon to provide assistance to the ship's carpenter in repairing the fractured main support beam. This was repaired with the use of a metal mechanical device called a **jackscrow**, which had been loaded on board to help in the construction of settler homes. It was now used to secure the beam to keep it from cracking further, making the ship seaworthy enough. * [22] * [23]

The crew of the *Mayflower* had some devices to assist them en route, such as a compass for navigation, as well as a log and line system to measure speed in nautical miles per hour (knots). Time was measured with the ancient method of an **hour glass**.

There were two deaths, but this was only a precursor of what happened after their arrival on Cape Cod.

28.3.3 Arrival in America

On November 9, 1620, they sighted present-day **Cape Cod**. They spent several days trying to sail south to their planned destination of the **Colony of Virginia**, where they had obtained permission to settle from the Company of Merchant Adventurers. However, strong winter seas forced them to return to the harbor at Cape Cod hook, well north of the intended area, where they anchored on November 11. The settlers wrote and signed the **Mayflower Compact** after the ship dropped anchor at Cape Cod, in what is now **Provincetown Harbor**, in order to establish legal order and to quell increasing strife within the ranks. * [24] * [25] * [26] * [27]

On Monday, November 27, an exploring expedition was launched under the direction of Capt. Christopher Jones to search for a suitable settlement site. As master of the *Mayflower*, Jones was not required to assist in the search, but he apparently thought it in his best interest to assist the search expedition. There were 34 persons in the open shallow: 24 passengers and 10 sailors. They were obviously not prepared for the bitter winter weather which they encountered on their reconnoiter, the *Mayflower* passengers not being accustomed to winter weather much colder than back home. They were forced to spend the night ashore due to the bad weather which they encountered, ill-clad in below-freezing temperatures with wet shoes and stockings that became frozen. Bradford wrote, "Some of our people that are dead took the original of their death here" on that expedition. * [28]

The settlers explored the snow-covered area and discovered an empty native village, now known as Corn Hill in Truro. The curious settlers dug up some artificially made mounds, some of which stored corn, while others were burial sites.

Nathaniel Philbrick claims that the settlers stole the corn and looted and desecrated the graves,* [29] sparking friction with the locals.* [30] Philbrick goes on to say that they explored the area of Cape Cod for several weeks as they moved down the coast to what is now Eastham, and he claims that the Pilgrims were looting and stealing native stores as they went.* [31] He then writes about how they decided to relocate to Plymouth after a difficult encounter with the Nausets at First Encounter Beach in December 1620.

However, Bradford's *History of Plymouth Plantation* steadfastly denies such revisionist theories. Bradford records that they took “some” of the corn to show the others back at the boat, leaving the rest. They later took what they needed from another store of grain, paying the locals back in six months, and it was gladly received.

Also there was found more of their corn and of their beans of various colors; the corn and beans they brought away, purposing to give them full satisfaction when they should meet with any of them as, about some six months afterward they did, to their good content.* [32]

28.3.4 First winter

During the winter, the passengers remained on board the *Mayflower*, suffering an outbreak of a contagious disease described as a mixture of scurvy, pneumonia, and tuberculosis. When it ended, only 53 passengers remained—just over half; half of the crew died, as well. In the spring, they built huts ashore, and the passengers disembarked from the *Mayflower* on March 21, 1621.

The settlers decided to mount “our great ordnances” on the hill overlooking the settlement in late February 1621, due to the fear of attack by the natives. Christopher Jones supervised the transportation of the “great guns”—about six iron cannons that ranged between four and eight feet (1.2 to 2.4 m) in length and weighed almost half a ton. The cannon were able to hurl iron balls 3.5 inches (8.9 cm) in diameter as far as 1,700 yards (1.5 km). This action made what was no more than a ramshackle village almost into a well-defended fortress.* [33]

Jones had originally planned to return to England as soon as the Pilgrims found a settlement site. But his crew members began to be ravaged by the same diseases that were felling the Pilgrims, and he realized that he had to remain in Plymouth Harbor “till he saw his men began to recover.”* [34] The *Mayflower* lay in New Plymouth harbor through the winter of 1620–21, then set sail for England on April 5, 1621, her empty hold ballasted with stones from the Plymouth Harbor shore. As with the Pilgrims, her sailors had been decimated by disease. Jones had lost his boatswain, his gunner, three quartermasters, the cook, and more than a dozen sailors.

The *Mayflower* made excellent time on her voyage back to England. The westerly winds that had buffeted her coming out pushed her along going home, and she arrived at the home port of Rotherhithe in London on May 6, 1621,* [35] less than half the time that it had taken her to sail to America.”* [36]

Jones died after coming back from a voyage to France on March 5, 1622, at about age 52. For the next two years, the *Mayflower* lay at her berth in Rotherhithe, not far from Jones' grave at St. Mary's church. By 1624, she was no longer useful as a ship; her subsequent fate is unknown, but she was probably broken up about that time.* [37]

28.4 Passengers

For more details on the passenger list, see [List of passengers on the Mayflower](#).

Some families traveled together, while some men came alone, leaving families in England and Leiden. Two wives on board were pregnant; Elizabeth Hopkins gave birth to son Oceanus while at sea, and Susanna White gave birth to son Peregrine in late November while the ship was anchored in Cape Cod Harbor. He is historically recognized as the first European child born in the New England area. One child died during the voyage, and there was one stillbirth during the construction of the colony.

Most of the passengers were Separatists, fleeing persistent religious persecution, but some were hired hands, servants, or farmers recruited by London merchants, all originally destined for the Colony of Virginia. Four of this latter group of passengers were small children given into the care of *Mayflower* pilgrims as indentured servants. The Virginia Company began the transportation of children in 1618.* [38] Until relatively recently, the children were thought to be orphans, foundlings, or involuntary child labor. At that time, children were routinely rounded up from the streets of London or taken from poor families receiving church relief to be used as laborers in the colonies. Any legal objections to the involuntary transportation of the children were over-ridden by the Privy Council.* [39]* [40] In 1959, it was

conclusively shown* [41] that the four **More children** were sent to America because they were deemed **illegitimate**. Three of the four More children died in the first winter in the New World, but **Richard** lived to be approximately 81, dying in Salem, probably in 1695 or 1696.*[42]

The passengers mostly slept and lived in the low-ceilinged great cabins and on the main deck, which was 75 by 20 (23 m × 6 m) at most. The cabins were thin-walled and extremely cramped, and the total area was 25 ft by 15 ft (7.6 m × 4.5 m) at its largest. Below decks, any person over five feet (150 cm) tall would be unable to stand up straight. The maximum possible space for each person would have been slightly less than the size of a standard single bed.*[43]

Passengers would pass the time by reading by candlelight or playing cards and games such as **Nine Men's Morris**.*[22] Meals on board were cooked by the **firebox**, which was an iron tray with sand in it on which a fire was built. This was risky because it was kept in the waist of the ship. Passengers made their own meals from rations that were issued daily and food was cooked for a group at a time.*[43]

Upon arrival late in the year, the harsh climate and scarcity of fresh food caused many more deaths, and provisions were short due to the delay in departure. Living in these extremely close and crowded quarters, several passengers experienced **scurvy**, a disease caused by a lack of the essential nutrient **vitamin C**. There was no way to store fruits or vegetables without their becoming rotten, so many passengers did not receive enough nutrients in their diets. Passengers with scurvy experienced symptoms such as rotten teeth which would fall out, bleeding gums, and stinking breath.*[44]

Passengers consumed large amounts of alcohol such as beer with meals which was known to be safer than water, which often came from polluted sources causing diseases. All food and drink was stored in barrels known as "**hogsheads**".*[44]

William Mullins took 126 pairs of shoes and 13 pairs of boots. These clothes included oiled leather and canvas suits, stuff gowns and leather and stuff breeches, shirts, jerkins, doublets, neckcloths, hats and caps, hose, stockings, belts, piece goods, and haberdasherie. At his death, his estate consisted of extensive footwear and other items of clothing, and made his daughter Priscilla and her husband John Alden quite prosperous.*[22]*[45]*[46]

No cattle or beasts of draft or burden were brought on the journey, but there were pigs, goats, and poultry. Some passengers brought family pets such as cats and birds. **Peter Browne** took his large bitch **mastiff**, and John Goodman brought along his **spaniel**.*[22]

28.5 *Mayflower* officers, crew, and others

According to author Charles Banks, the officers and crew of the *Mayflower* consisted of a captain, four mates, four quartermasters, surgeon, carpenter, cooper, cooks, boatswains, gunners, and about 36 men before the mast, making a total of about 50. The entire crew stayed with the *Mayflower* in Plymouth through the winter of 1620–1621, and about half of them died during that time. The remaining crewmen returned to England on the *Mayflower*, which sailed for London on April 5, 1621.*[47]*[48]

28.5.1 Crew members per various sources

Banks states that the crew totaled 36 men before the mast and 14 officers, making a total of 50. Nathaniel Philbrick estimates between 20 and 30 sailors in her crew whose names are unknown. Nick Bunker states that *Mayflower* had a crew of at least 17 and possibly as many as 30. Caleb Johnson states that the ship carried a crew of about 30 men, but the exact number is unknown.*[3]*[49]*[50]*[51]

28.5.2 Officers and crew

- **Captain:** Christopher Jones. About age 50, of Harwich, a seaport in Essex, England, which was also the port of his ship *Mayflower*. He and his ship were veterans of the European cargo business, often carrying wine to England, but neither had ever crossed the Atlantic. By June 1620, he and the *Mayflower* had been hired for the Pilgrims voyage by their business agents in London, Thomas Weston of the Merchant Adventurers and **Robert Cushman**.*[52]*[53]
- **Masters Mate:** John Clark (Clarke), Pilot. By age 45 in 1620, Clark already had greater adventures than most other mariners of that dangerous era. His piloting career began in England about 1609. In early 1611, he was

pilot of a 300-ton ship on his first New World voyage, with a three-ship convoy sailing from London to the new settlement of **Jamestown** in Virginia. Two other ships were in that convoy, and the three ships brought 300 new settlers to Jamestown, going first to the Caribbean islands of **Dominica** and **Nevis**. While in Jamestown, Clark piloted ships in the area carrying various stores. During that time, he was taken prisoner in a confrontation with the Spanish; he was taken to Havana and held for two years, then transferred to Spain where he was in custody for five years. In 1616, he was finally freed in a prisoner exchange with England. In 1618, he was back in Jamestown as pilot of the ship *Falcon*. Shortly after his return to England, he was hired as pilot for the *Mayflower* in 1620. *[\[50\]](#) *[\[54\]](#) *[\[55\]](#) *[\[56\]](#)

- **Masters Mate: Robert Coppin, Pilot.** Coppin had prior New World experience; he previously hunted whales in Newfoundland and sailed the coast of New England. *[\[50\]](#) *[\[54\]](#) *[\[57\]](#) He was an early investor in the Virginia Company, being named in the Second Virginia Charter of 1609. He was possibly from Harwich in Essex, the hometown of Captain Jones.
- **Masters Mate: Andrew Williamson**
- **Masters Mate: John Parker** *[\[54\]](#)
- **Surgeon: Doctor Giles Heale.** The surgeon on board the *Mayflower* was never mentioned by Bradford, but his identity was well established. He was essential in providing comfort to all who died or were made ill that first winter. He was a young man from Drury Lane in the parish of St. Giles in the Field, London who had completed his apprenticeship with the Barber-Surgeons in the previous year. On February 21, 1621, he was a witness to the death-bed will of **William Mullins**. He survived the first winter and returned to London on the *Mayflower* in April 1621, where he began his medical practice and worked as a surgeon until his death in 1653. *[\[58\]](#) *[\[59\]](#) *[\[60\]](#)
- **Cooper: John Alden.** Alden was a 21-year-old from Harwich in Essex and a distant relative of Captain Jones. He hired on apparently while the *Mayflower* was anchored at Southampton Waters. He was responsible for maintaining the ship's barrels, known as hogsheads, which were critical to the passengers' survival and held the only source of food and drink while at sea; tending them was a job which required a crew member's attention. Bradford noted that Alden was "left to his own liking to go or stay" in Plymouth rather than return with the ship to England. He decided to remain. *[\[61\]](#) *[\[62\]](#)
- **Quartermaster: (names unknown), 4 men.** These men were in charge of maintaining the ship's cargo hold, as well as the crew's hours for standing watch. Some of the "before the mast" crewmen may also have been in this section. These quartermasters were also responsible for fishing and maintaining all fishing supplies and harpoons. The names of the quartermasters are unknown, but it is known that three of the four men died the first winter. *[\[54\]](#) *[\[56\]](#)
- **Cook: (name unknown).** He was responsible for preparing the crew's meals and maintaining all food supplies and the cook room, which was typically located in the ship's forecabin (front end). The unnamed cook died the first winter. *[\[63\]](#)
- **Master Gunner: (name unknown).** He was in charge of the ship's guns, ammunition, and powder. Some of those "before the mast" were likely in his charge. He is recorded as going on an exploration on December 6, 1620, and was "sick unto death and so remained all that day, and the next night". He died later that winter. *[\[64\]](#)
- **Boatswain: (name unknown).** He was the person in charge of the ship's rigging and sails, the anchors, and the ship's longboat. The majority of the crew members "before the mast" were most likely under his supervision, working the sails and rigging. The operation of the ship's shallow was also probably under his control, a light open boat with oars or sails (see seaman Thomas English). William Bradford made this comment about the boatswain: "the boatswain... was a proud young man, who would often curse and scoff at the passengers, but when he grew weak they had compassion on him and helped him." But despite such assistance, the unnamed boatswain died the first winter. *[\[63\]](#)
- **Carpenter: (name unknown).** He was responsible for making sure that the hull was well-caulked and the masts were in good order. He was the person responsible for maintaining all areas of the ship in good condition and being a general repairman. He also maintained the tools and all necessary items to perform his carpentry tasks. His name is unknown, but his tasks were quite important to the safety and seaworthiness of the ship. *[\[54\]](#) *[\[65\]](#)
- **Swabber: (various crewmen).** This was the lowliest position on the ship, responsible for cleaning (swabbing) the decks. The swabber usually had an assistant who was responsible for cleaning the ship's beakhead (extreme front end), which was also the crew's toilet. *[\[66\]](#)

28.5.3 Known *Mayflower* seamen

- John Allerton: A *Mayflower* seaman who was hired by the company as labor to help in the Colony during the first year, then to return to Leiden to help other church members seeking to travel to America. He signed the *Mayflower Compact*. He was a seaman on ship's shallop with Thomas English on exploration of December 6, 1620, and died sometime before the *Mayflower* returned to England in April 1621. *[\[67\]](#) *[\[68\]](#)
- ____ Ely: A *Mayflower* seaman who was contracted to stay for a year, which he did. He returned to England with fellow crewman William Trevor on the *Fortune* in December 1621. Genealogist Dr. Jeremy Bangs believes that his name was either John or Christopher Ely (or Ellis), both of whom are documented in Leiden, Holland. *[\[69\]](#)
- Thomas English: A *Mayflower* seaman who was hired to be the master of the shallop (see Boatswain) and to be part of the company. He signed the *Mayflower Compact*. He was a seaman on the ship's shallop with John Allerton on exploration of December 6, 1620, and died sometime before the departure of the *Mayflower* for England in April 1621. He appeared in Leiden records as “Thomas England” . *[\[70\]](#) *[\[71\]](#)
- William Trevore (Trevor): A *Mayflower* seaman who was hired to remain in Plymouth for one year. One reason for his hiring was his prior New World experience. He was one of those seamen to crew the shallop used in coastal trading. He returned to England with ____ Ely and others on the *Fortune* in December 1621. In 1623, Robert Cushman noted that Trevor reported to the Adventurers about what he saw in the New World. He did at some time return as master of a ship and was recorded living in Massachusetts Bay Colony in April 1650. *[\[72\]](#) *[\[73\]](#) *[\[74\]](#)

28.5.4 Unidentified passenger

- “Master” Leaver: Another passenger not mentioned by Bradford is a person called “Master” Leaver. He was named in *Mourt's Relation*, London 1622, under a date of January 12, 1621 as a leader of an expedition to rescue Pilgrims lost in the forest for several days while searching for housing-roof thatch. It is unknown in what capacity he came to the *Mayflower* and his given name is unknown. The title of “Master” indicates that he was a person of some authority and prominence in the company. He may have been a principal officer of the *Mayflower*. No more is known of him; he may have returned to England on the *Mayflower's* April 1621 voyage or died of the illnesses that affected so many that first winter. *[\[75\]](#)

28.6 Later history

Three of *Mayflower's* owners applied to the Admiralty court for an appraisal of the ship on May 4, 1624, two years after Captain Jones' death in 1622; one of these applicants was Jones' widow Mrs. Josian (Joan) Jones. This appraisal probably was made to determine the valuation of the ship for the purpose of settling the estate of its late master. The appraisal was made by four mariners and shipwrights of Rotherhithe, home and burial place of Captain Jones, where the *Mayflower* was apparently then lying in the *Thames* at London. The appraisal is extant and provides information on ship's gear on board at that time, as well as equipment such as muskets and other arms. The ship may have been laid up since Jones' death and allowed to get out of repair, as that is what the appraisal indicates. *[\[15\]](#) *[\[76\]](#) The vessel was valued at one hundred and twenty-eight pounds, eight shillings, and fourpence. *[\[77\]](#)

What finally became of the *Mayflower* is an unsettled issue. Charles Edward Banks, an English historian of the Pilgrim ship, claims that the ship was finally broken up, with her timbers used in the construction of a barn at *Jordans* village in *Buckinghamshire*. Tradition claims that this barn still exists as the *Mayflower Barn*, located within the grounds of Old Jordan in South Buckinghamshire. In 1624, Thomas Russell supposedly added to part of a farmhouse already there with timbers from a ship, believed to be from the Pilgrim ship *Mayflower*, bought from a shipbreaker's yard in *Rotherhithe*. The well-preserved structure was a tourist attraction, receiving visitors each year from all over the world and particularly from America, but it is now privately owned and not open to the public. *[\[15\]](#)

28.7 Second *Mayflower*

Another ship called the *Mayflower* made a voyage from London to Plymouth Colony in 1629 carrying 35 passengers, many from the Pilgrim congregation in *Leiden* that organized the first voyage. This was not the same ship that made

the original voyage with the first settlers. This voyage began in May and reached Plymouth in August. This ship also made the crossing from England to America in 1630 (as part of the **Winthrop Fleet**), 1633, 1634, and 1639. It attempted the trip again in 1641, departing London in October of that year under master John Cole, with 140 passengers bound for Virginia. It never arrived. On October 18, 1642 a deposition was made in England regarding the loss.*[78]

28.8 Place in history

The Pilgrim ship *Mayflower* has a famous place in American history as a symbol of early European colonization of the future United States.*[79]

The **main record** for the voyage of the *Mayflower* and the disposition of the Plymouth Colony comes from the letters and journal of **William Bradford**, who was a guiding force and later the **governor** of the **colony**.

The 400th anniversary of the *Mayflower* sailing will take place in 2020. The **Harwich Mayflower Project** is hoping to build a replica of the ship at Harwich, England.*[80]

28.9 See also

- **Billericay**, where the Pilgrim Fathers met prior to the voyage
- **Leigh-on-Sea**, where the *Mayflower* was outfitted
- **Pilgrims (Plymouth Colony)**
- **Puritan migration to New England (1620–40)**
- *Plymouth Adventure* (directed by Clarence Brown, 1952)
- *Mayflower: The Pilgrims' Adventure* (1979)
- *Mayflower II*, a replica of the *Mayflower* in Plymouth, Massachusetts
- *Speedwell* (1577 ship)

28.10 References

- [1] Wickham, Parnel. Separating the Pilgrims From the Puritans. *The New York Times*. 24 October 1999
- [2] Folsom, George. et al. *Historical Magazine: and Notes and Queries Concerning the Antiquities, History, and Biography of America*. (C. B. Richardson, 1867) page 277
- [3] Caleb H. Johnson, *The Mayflower and Her Passengers* (Indiana: Xlibris Corp., 2006), p. 33
- [4] Bertrand Brown, 'To Celebrate the 300th Anniversary of America's Origin', *The Journal of Education* , Vol. 92, No. 6 (Trustees of Boston University, August 1920), p. 151
- [5] Nathaniel Philbrick, *Mayflower: A Story of Courage, Community and War* (Penguin Books 2006), p. 24
- [6] Nick Bunker, *Making Haste from Babylon: The Mayflower Pilgrims and their New World a History* (New York: Knopf 2010), p. 37
- [7] Caleb H. Johnson, *The Mayflower and Her Passengers* (Indiana: Xlibris Corp., 2006), p. 30
- [8] “Cross-Section” . *MayflowerHistory.com*.
- [9] Caleb H. Johnson, *The Mayflower and Her Passengers* (Indiana: Xlibris Corp., 2006), p. 31
- [10] “MayflowerHistory.com” .
- [11] Caleb H. Johnson, *The Mayflower and Her Passengers* (Indiana: Xlibris Corp., 2006), pp. 30, 31

- [12] Charles Edward Banks, *The English Ancestry and Homes of the Pilgrim Fathers Who Came to Plymouth on the Mayflower in 1620, the "Fortune" in 1621, and the "Anne" and "Little James" in 1623* (orig. pub: 1929, reprint: 2006 by Genealogical Publishing Co.), p. 19
- [13] Charles Edward Banks, *The English Ancestry and Homes of the Pilgrim Fathers Who came to Plymouth on the "Mayflower" in 1620, the "Fortune" in 1621, and the "Anne" and "Little James" in 1623* (orig. pub: 1929 reprint: 2006 by Genealogical Publishing Co.), p. 17.
- [14] "The Mayflower" . *HISTORY.com*.
- [15] Charles Edward Banks, *The English Ancestry and Homes of the Pilgrim Fathers Who Came to Plymouth on the "Mayflower" in 1620, the "Fortune" in 1621, and the "Anne" and "Little James" in 1623* (orig. pub: 1929 reprint: 2006 by Genealogical Publishing Co.), p. 22
- [16] R. G. Marsden, "The Mayflower" , *English Historical Review* (19 October 1904), p. 675
- [17] Nathaniel Philbrick, *Mayflower: A Story of Courage, Community and War*, (Penguin Books 2006), p. 28
- [18] Charles Edward Banks, *The English Ancestry and Homes of the Pilgrim Fathers Who Came to Plymouth on the "Mayflower" in 1620, the "Fortune" in 1621, and the "Anne" and "Little James" in 1623*, (orig. pub: 1929 reprint: 2006 by Genealogical Publishing Co.), pp. 17–19
- [19] Nathaniel Philbrick, *Mayflower: A Story of Courage, Community and War*, (Penguin Books 2006), p. 29
- [20] John Boulden (2013). "Newlyn was last port for Mayflower" . *The Herald*. Retrieved 12 December 2014.
- [21] "Tregwary Cottage: Some "interesting" facts about Newlyn" . tregwarycottage.co.uk. Retrieved 15 August 2012.
- [22] Hodgson, Godfrey. *A Great and Godly Adventure*. Public Affairs: New York, 2006
- [23] Nathaniel Philbrick, *Mayflower: A Story of Courage, Community and War*, (Penguin Books 2006), p. 4
- [24] Eugene Aubrey Stratton. *Plymouth Colony: Its History and People, 1620–1691*, (Ancestry Publishing, Salt Lake City, UT, 1986) p. 413
- [25] Bjoern Moritz, *The Pilgrim-Fathers' Voyage with the Mayflower* (ShipsOnStamps 2003)
- [26] William Bradford. *History of Plymouth Plantation by William Bradford, the second Governor of Plymouth* (Boston. 1856 Not in copyright) p. 448
- [27] George Ernest Bowman, *The Mayflower Compact and its signers*, (Boston: Massachusetts Society of Mayflower Descendants, 1920). Photocopies of the 1622, 1646 and 1669 versions of the document pp. 7–19.
- [28] Nathaniel Philbrick, *Mayflower: A Story of Courage, Community and War*, (Penguin Books 2006), pp. 65–66
- [29] Philbrick, pp. 61–62
- [30] Winslow, Edward; William Bradford (1622). *A Relation or Journal of the Beginning and Proceedings of the English Plantation Settled at Plimoth in New England*. London, England: John Bellamie. pp. 8–10.
- [31] Philbrick, pp. 65–70
- [32] William Bradford, William T. Davis (ed), *Bradford's History of Plymouth Plantation, 1606–1646*, (Scribners 1908) p. 25 (the only written account of the voyage)
- [33] Nathaniel Philbrick, *Mayflower: A Story of Courage, Community and War*, (Penguin Books 2006), pp. 90–91
- [34] Nathaniel Philbrick, *Mayflower: A Story of Courage, Community and War*, (Penguin Books 2006), p. 91
- [35] John Harris, *Saga Of The Pilgrims*(historical analysis), (Globe Newspaper Co., 1983), webpages (no links between): [UCcom-saga1](#) and [UCcom-saga11](#)
- [36] Nathaniel Philbrick, *Mayflower: A Story of Courage, Community and War*, (Penguin Books 2006), pp. 100–101
- [37] Nathaniel Philbrick, *Mayflower: A Story of Courage, Community and War*, (Penguin Books 2006), p. 101
- [38] Donald F. Harris, PhD., *The Mayflower Descendant* (July 1994) vol. 44 no. 2 p. 111
- [39] R.C. Johnson, *The Transportation of Vagrant Children from London to Virginia, 1618–1622*, in H.S. Reinmuth (Ed.), *Early Stuart Studies: Essays in Honor of David Harris Willson*, Minneapolis, 1970.
- [40] *The Mayflower Descendant* (July 2, 1994) vol. 44 no. 2 pp. 110, 111

- [41] Donald F. Harris, PhD., *The Mayflower Descendants*. vol 43 (July 1993), vol. 44 (July 1994).
- [42] David Lindsay, *Mayflower Bastard: A Stranger amongst the Pilgrims* (St. Martins Press, New York, 2002) Introduction
- [43] Caffrey, Kate. *The Mayflower*. New York: Stein and Day, 1974
- [44] Nathaniel Philbrick, *Mayflower: A Story of Courage, Community, and War*, (Viking 2006).
- [45] Caleb H. Johnson, *The Mayflower and Her Passengers* (Indiana: Xlibris Corp., 2006), p. 195
- [46] Charles Edward Banks, *The English ancestry and homes of the Pilgrim Fathers who came to Plymouth on the "Mayflower" in 1620, the "Fortune" in 1621, and the "Anne" and the "Little James" in 1623*, (Baltimore: Genealogical Publishing Company, 2006), pp. 73–74
- [47] Charles Edward Banks, *The English Ancestry and Homes of the Pilgrim Fathers: who came to Plymouth on the "Mayflower" in 1620, the "Fortune" in 1621, and the "Anne" and the "Little James" in 1623* (Baltimore, MD.:Genealogical Publishing Co., 2006) p. 18
- [48] Eugene Aubrey Stratton. *Plymouth Colony: Its History and People, 1620–1691*, (Ancestry Publishing, Salt Lake City, UT, 1986) p. 21
- [49] Charles Edward Banks, *The English Ancestry and Homes of the Pilgrim Fathers Who Came to Plymouth on the "Mayflower" in 1620, the "Fortune" in 1621, and the "Anne" and "Little James" in 1623*, (orig. pub: 1929 reprint: 2006 by Genealogical Publishing Co.), pp. 18–19
- [50] Nathaniel Philbrick, *Mayflower: A story of Courage, Community and War* (New York:Viking, 2006), p. 25
- [51] Nick Bunker, *Making Haste from Babylon: The Mayflower Pilgrims and their New World a History* (New York: Knopf 2010), p. 31
- [52] Charles Edward Banks, *The English Ancestry and Homes of the Pilgrim Fathers: who came to Plymouth on the "Mayflower" in 1620, the "Fortune" in 1621, and the "Anne" and the "Little James" in 1623* (Baltimore, MD.:Genealogical Publishing Co., 2006) pp. 19–20
- [53] Caleb H. Johnson, *The Mayflower and her passengers* (Indiana:Xlibris Corp., Caleb Johnson, 2006) pp. 25, 28, 31
- [54] Charles Edward Banks, *The English Ancestry and Homes of the Pilgrim Fathers: who came to Plymouth on the "Mayflower" in 1620, the "Fortune" in 1621, and the "Anne" and the "Little James" in 1623* (Baltimore, MD.:Genealogical Publishing Co., 2006) p. 19
- [55] Nick Bunker, *Making Haste from Babylon: The Mayflower Pilgrims and their New World a History* (New York: Knopf 2010), p. 24
- [56] Caleb H. Johnson, *The Mayflower and her passengers* (Indiana:Xlibris Corp., Caleb Johnson, 2006), pp. 32–33
- [57] Caleb H. Johnson, *The Mayflower and her passengers* (Indiana:Xlibris Corp., Caleb Johnson, 2006), p. 32
- [58] Nathaniel Philbrick, *Mayflower: A story of Courage, Community and War* (New York:Viking, 2006), p. 24
- [59] Caleb H. Johnson, *The Mayflower and her passengers* (Indiana:Xlibris Corp., Caleb Johnson, 2006), pp. 33–34
- [60] Charles Edward Banks, *The English Ancestry and Homes of the Pilgrim Fathers: who came to Plymouth on the "Mayflower" in 1620, the "Fortune" in 1621, and the "Anne" and the "Little James" in 1623* (Baltimore, MD.:Genealogical Publishing Co., 2006) pp. 7–8, 19
- [61] Caleb H. Johnson, *The Mayflower and her passengers* (Indiana:Xlibris Corp., Caleb Johnson, 2006), p. p. 34, 46
- [62] Charles Edward Banks, *The English Ancestry and Homes of the Pilgrim Fathers: who came to Plymouth on the "Mayflower" in 1620, the "Fortune" in 1621, and the "Anne" and the "Little James" in 1623* (Baltimore, MD.:Genealogical Publishing Co., 2006) pp. 7, 19. 27–28
- [63] Caleb H. Johnson, *The Mayflower and her passengers* (Indiana:Xlibris Corp., Caleb Johnson, 2006), p. 35
- [64] Caleb H. Johnson, *The Mayflower and her passengers* (Indiana:Xlibris Corp., Caleb Johnson, 2006), p. 34
- [65] Caleb H. Johnson, *The Mayflower and her passengers* (Indiana:Xlibris Corp., Caleb Johnson, 2006), pp. 34–35
- [66] In the tradition of the sea, each Monday a crew member was appointed the "liar" or swabber assistant. This person was the first person caught telling a lie the previous week, and the crew would harass him around the main mast with calls of "liar, liar." (Johnson p. 35)

- [67] Caleb H. Johnson, *The Mayflower and her passengers* (Indiana:Xlibris Corp., Caleb Johnson, 2006), pp. 71–72, 141
- [68] Eugene Aubrey Stratton. *Plymouth Colony: Its History and People, 1620–1691*, (Ancestry Publishing, Salt Lake City, UT, 1986) pp. 21, 234
- [69] Eugene Aubrey Stratton. *Plymouth Colony: Its History and People, 1620–1691*, (Ancestry Publishing, Salt Lake City, UT, 1986) pp. 21, 289
- [70] Caleb H. Johnson, *The Mayflower and her passengers* (Indiana:Xlibris Corp., Caleb Johnson, 2006), p. 141
- [71] Eugene Aubrey Stratton. *Plymouth Colony: Its History and People, 1620–1691*, (Ancestry Publishing, Salt Lake City, UT, 1986) p. 289
- [72] Charles Edward Banks, *The English Ancestry and Homes of the Pilgrim Fathers: who came to Plymouth on the “Mayflower” in 1620, the “Fortune” in 1621, and the “Anne” and the “Little James” in 1623* (Baltimore, MD.:Genealogical Publishing Co., 2006) p. 90
- [73] Caleb H. Johnson, *The Mayflower and her passengers* (Indiana:Xlibris Corp., Caleb Johnson, 2006), pp. 240–242
- [74] Eugene Aubrey Stratton. *Plymouth Colony: Its History and People, 1620–1691*, (Ancestry Publishing, Salt Lake City, UT, 1986) pp. 21, 364
- [75] Charles Edward Banks, *The English Ancestry and Homes of the Pilgrim Fathers: who came to Plymouth on the “Mayflower” in 1620, the “Fortune” in 1621, and the “Anne” and the “Little James” in 1623* (Baltimore, MD.:Genealogical Publishing Co., 2006) pp. 8–9
- [76] R. G. Marsden, *The Mayflower* English Historical Review (19 October 1904), p. 677
- [77] Kate Caffrey, *The Mayflower* Rowman & Littlefield Publishers; Reissue edition (October 18, 2014), p. 324
- [78] Pierson, Richard E.; Pierson, Jennifer (1997). *Pierson Millennium*. Bowie, Maryland: Heritage Books, Inc. ISBN 0-7884-0742-2.
- [79] Philbrick, pp. 4–5
- [80] “Ship Build” . *Harwich Mayflower Project*. Retrieved 1 April 2017.

28.11 Further reading

- Bradford, William (1908). Davis, William T., ed. *Bradford's History of Plymouth Plantation, 1606–1646*. Scribners. (the only written account of the voyage)
- Marble, Annie Russell (1920). *The Women Who Came in the Mayflower*. Boston: Pilgrim Press
- R. G. Marsden, “The 'Mayflower,'" *English Historical Review* 19 (October 1904): 669–80.
- Philbrick, Nathaniel (2006). *Mayflower: A Story of Courage, Community, and War*. Viking. ISBN 0-670-03760-5.
- Usher, Roland G (1984). *The Pilgrims and their History*. Williamstown, Massachusetts: Corner House Publishers. ISBN 0-87928-082-4. (originally published in 1918)

28.12 External links

- *Mayflower* and Plymouth History
- Mayflower 400
- Women of the *Mayflower* and Plymouth Colony by Mary Soule Googins, read before the Medford Historical Society, December 19, 1921
- Pilgrim Hall Museum of Plymouth, Massachusetts
- General Society of *Mayflower* Descendants

- The *Mayflower* And Her Log; Azel Ames, Project Gutenberg edition.
- The *Mayflower* And Her Log; Azel Ames, Internet Archive edition.
- Exact arrival site of the *Mayflower* on Satellite Map and NOAA Chart on BlooSee
- The *Mayflower II*
- Contemporary photos of Plymouth's Barbican and the Mayflower Steps
- Pilgrims Point, Plymouth (UK) A photo of the modern-day Mayflower Steps Arch and Pilgrims Point
- "Mayflower, The". *Encyclopedia Americana*. 1920.





Edward Winslow's home, now the Mayflower House Museum, Plymouth, Massachusetts (1754)

Chapter 29

Miasma theory

“Bad air” redirects here. For the condition of air that does not meet the requirements of one or more biotic species, see [Bad air quality](#).

The **miasma theory** (also called the **miasmatic theory**) is an obsolete medical theory that held that **diseases** - such



A representation by Robert Seymour of the cholera epidemic of the 19th century depicts the spread of the disease in the form of poisonous air.

as **cholera**, **chlamydia**, or the **Black Death** - were caused by a *miasma* (μίασμα, ancient Greek: “pollution”), a noxious form of “bad air” , also known as **night air**. The theory held that the origin of **epidemics** was due to a miasma, emanating from rotting organic matter.*[1] Though miasma theory is typically associated with the spread of disease, some academics in the early nineteenth century suggested that the theory extended to other conditions as well, e.g. one could become obese by inhaling the odor of food.*[2]

The miasma theory was accepted from ancient times in Europe, and China. The theory was eventually given up by scientists and physicians after 1880, replaced by the **germ theory of disease**: specific germs, not miasma, caused

specific diseases. However, cultural beliefs about getting rid of odor made the clean-up of waste a high priority for cities. ^[3]^[4]

29.1 Etymology

The word *miasma* comes from ancient Greek and means “pollution”. ^[5] The idea also gave rise to the name *malaria* (literally “bad air”) through medieval Italian.

29.2 Views worldwide

Miasma was considered to be a poisonous vapor or mist filled with particles from decomposed matter (*miasmata*) that caused illnesses. The miasmatic position was that diseases were the product of environmental factors such as contaminated water, foul air, and poor hygienic conditions. Such infection was not passed between individuals but would affect individuals within the locale that gave rise to such vapors. It was identifiable by its foul smell. It was also initially believed that miasmas were propagated through worms from ulcers within those affected by a plague. ^[6]

In *India*, there was also a miasma theory and the Indians take credit for being the first to put this miasma theory into clinical practice. The Indians invented *paan*, a gambir paste, that was believed to help prevent miasma; it was considered as the first antimiasmatic application. This *gambir tree* is found in Southern India and Sri Lanka. ^[7]

In the 1st century BC, the Roman architectural writer *Vitruvius* described the potential effects of miasma (*Latin nebula*) from fetid swamplands when visiting a city:

For when the morning breezes blow toward the town at sunrise, if they bring with them mist from marshes and, mingled with the mist, the poisonous breath of creatures of the marshes to be wafted into the bodies of the inhabitants, they will make the site unhealthy. ^[8]

The miasmatic theory of disease remained popular in the *Middle Ages* and a sense of *effluvia* contributed to Robert Boyle's *Suspensions about the Hidden Realities of the Air*.

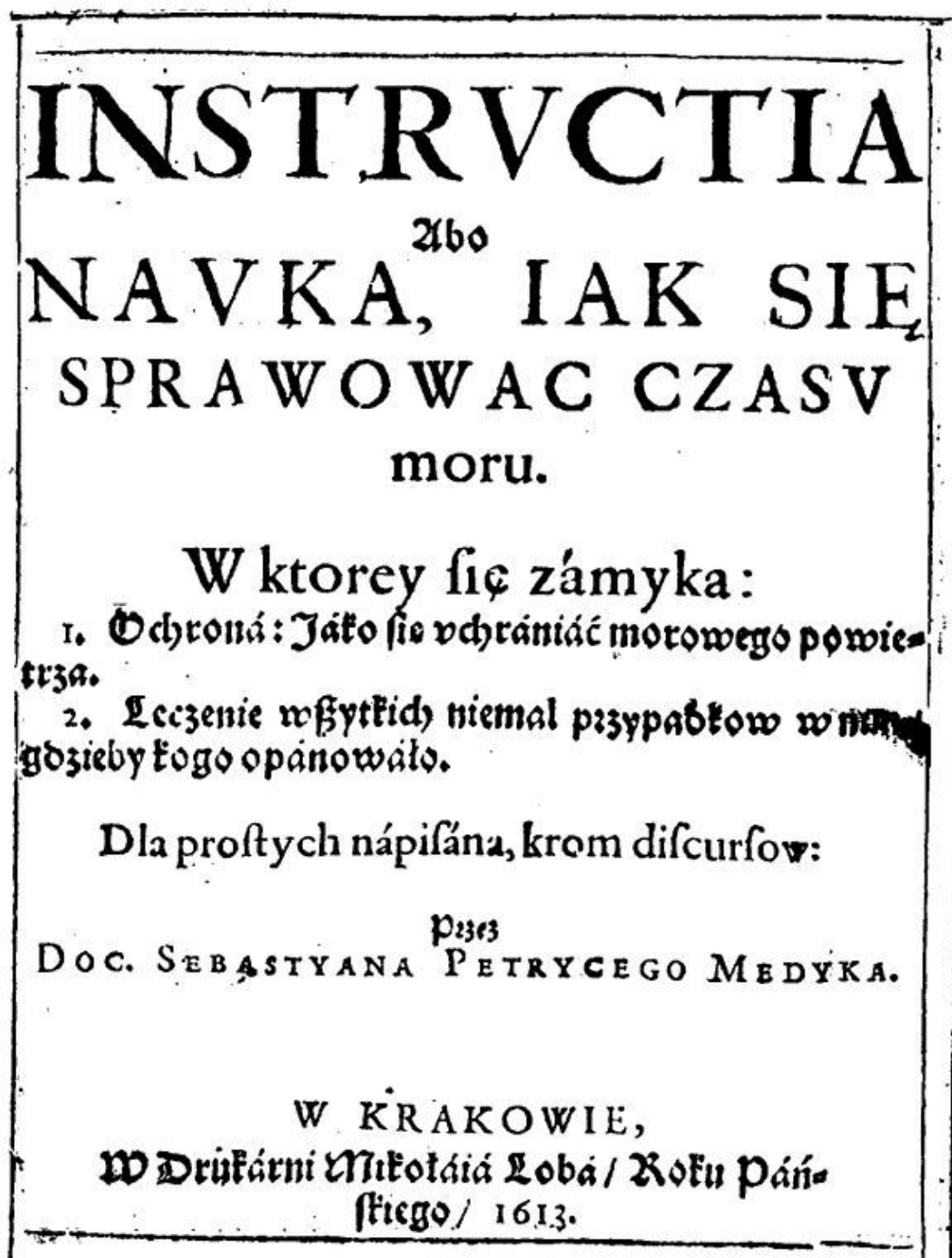
In the 1850s, miasma was used to explain the spread of *cholera* in *London* and in *Paris*, partly justifying *Haussmann's later renovation of the French capital*. The disease was said to be preventable by cleansing and scouring of the body and items. *Dr. William Farr*, the assistant commissioner for the 1851 London census, was an important supporter of the miasma theory. He believed that cholera was transmitted by air, and that there was a deadly concentration of *miasmata* near the *River Thames'* banks. Such a belief was in part accepted because of the general lack of air quality in urbanized areas. ^[2] The wide acceptance of miasma theory during the cholera outbreaks overshadowed the partially correct theory brought forth by *John Snow* that cholera was spread through water. This slowed the response to the major outbreaks in the Soho district of London and other areas. The *Crimean War* nurse *Florence Nightingale* (1820–1910) ^[9]^[10]^[11] was a proponent of the theory and worked to make hospitals sanitary and fresh-smelling. It was stated in 'Notes on Nursing for the Labouring Classes' (1860) that Nightingale would “keep the air [the patient] breathes as pure as the external air.” ^[12]

Fear of miasma registered in many early nineteenth century warnings concerning what was termed “unhealthy fog”. The presence of fog strongly indicated the presence of miasma. The miasmas behaved like smoke or mist, blown with air currents, wafted by winds. It did not simply travel on air, it changed the air through which it propagated. The atmosphere was infected by miasma, as diseased people were. ^[13] Many believed miasma was magical, and was able to change the properties of the air and atmosphere completely.

29.2.1 China

In China, miasma (*Chinese*: 瘴氣; *pinyin*: *Zhàngqì*; alternate names 瘴毒, 瘴癘) is an old concept of illness, used extensively by ancient Chinese local chronicles and works of literature. Miasma has different names in Chinese culture. Most of the explanations of miasma refer to it as a kind of sickness, or poison gas.

The ancient Chinese thought that miasma was related to the environment of parts of Southern China. The miasma was thought to be caused by the heat, moisture and the dead air in the Southern Chinese mountains. They thought



Book of Sebastian Petrycy published in Kraków in 1613 about prevention against "bad air" .

that insects' waste polluted the air, the fog, water, and the virgin forest harboring a great environment for miasma to occur.

In the descriptions of ancient travelers, soldiers, or local officials (most of them are men of letters) of the phenomenon of miasma, fog, haze, dust, gas, or poison geological gassing were always mentioned. The miasma caused a lot of diseases such as the cold, influenza, heat strokes, malaria, or dysentery. In the medical history of China, malaria had been referred to by different names in different dynasty periods. Poisoning and psittacosis were also called miasma in ancient China because they did not accurately understand the cause of disease.

In Sui dynasty, doctor Tsao Yuan-fung mentioned miasma in his book *On Pathogen and Syndromes* (諸病源候論). He thought that miasma in Southern China is similar with typhoid fever in Northern China. However, in his opinion, miasma is different from malaria and dysentery. In his book, he discussed dysentery in another chapter, and malaria in a single chapter. And he also found that miasma caused different diseases, so he suggested that one should find apt and specific ways to resolve problems.*[14]

The knowing of the concept of miasma can be separated into several steps. First, before Western Jin Dynasty, the concept of miasma was gradually forming; at least, in Eastern Han Dynasty, there was no character of miasma. In Eastern Jin, large amounts of northern people moved toward south, miasma was recognized then in the group of men of letters or nobility. After Sui and Tang Dynasty, scholars-bureaucrats traveled and were sent to be the local officials recorded and investigated the miasma. As a result, the government became concerned about the severe cases and the causes of miasma by sending doctors to the area of epidemic to research the disease and heal the patients. In Ming and Qing Dynasties, the edition of the local chronicles record the different miasma in different places.*[15]

However, Southern China was highly developed in Ming and Qing Dynasties. The environment changed rapidly, and after the 19th century, western science and medical knowledge were introduced into China, and people knew how to distinguish and deal with the disease. The concept of miasma therefore faded out, due to the progression of medicine in China.*[16]

29.2.2 Influence in Southern China

The terrifying miasma diseases in the southern regions of China made it the primary location for relegating officials and sending criminals to exile since the Qin-Han Dynasty. Poet Han Yu (韓愈) of the Tang Dynasty, for example, wrote to his nephew who came to see him off after his banishment to the Chao Prefecture in his poem, *En Route**[17] (左遷至藍關示姪孫湘):

At dawn I sent a single warning to the throne of the Nine Steps;
At evening I was banished to Chao Yang, eight thousand leagues.
Striving on behalf of a noble dynasty to expel an ignoble government,
How should I, withered and worn, deplore my future lot?
The clouds gather on Ch'in Mountains, I cannot see my home;
The snow bars the passes of Lan, my horse cannot go forward.
But I know that you will come from afar, to fulfil your set purpose,
And lovingly gather my bones, on the banks of that plague-stricken river.

The prevalent belief and predominant fear of the southern region with its “poisonous air and gases” is evident in historical documents.

Similar topics and feelings toward the miasma-infected south are often reflected in early Chinese poetry and records. Most scholars of the time agreed that the geological environments in the south had a direct impact on the population composition and growth. Many historical records reflect that females were less prone to miasma infection, and mortality rates were much higher in the south, especially for the men. This directly influenced agriculture cultivation and the southern economy, as men were the engine of agriculture production. Zhou Qufei (周去非), a local magistrate from the Nan-Sung Dynasty described in his treatise, *Representative Answers from the South*: “... The men are short and tan, while the women were plump and seldom came down with illness,”*[18] and exclaimed at the populous female population in the GuangXi region.

This inherent environmental threat also prevented immigration from other regions. Hence, development in the damp and sultry south was much slower than in the north, where the dynasties' political power resided for much of early Chinese history.*[19]

29.3 Developments from 19th century onwards

29.3.1 Zymotic theory

Based on “zymotic” theory, people believed vapors called “miasmata” (singular: “miasma”) rose from the soil and spread diseases. Miasmata were believed to come from rotting vegetation and foul water—especially in swamps and urban ghettos.

Many people, especially the weak or infirm, avoided breathing night air by going indoors and keeping windows and doors shut. In addition to ideas associated with zymotic theory, there was also a general fear that cold or cool air spread disease. The fear of night air gradually disappeared as understanding about disease increased as well as with improvements in home heating and ventilation. Particularly important was the understanding that the agent spreading malaria was the mosquitoes (active at night) rather than miasmata.* [20]

29.3.2 Contagionism versus miasmatism

Prior to the late 19th century, **night air** was considered dangerous in most Western cultures. Throughout the 19th century, the medical community was divided on the explanation for disease proliferation. On one side were the contagionists, believing disease was passed through physical contact, while others believed disease was present in the air in the form of miasma, and thus could proliferate without physical contact. Two members of the latter group were Dr. Thomas S. Smith and Florence Nightingale.

Thomas Southwood Smith spent many years comparing the miasmatic theory to contagionism.

To assume the method of propagation by touch, whether by the person or of infected articles, and to overlook that by the corruption of the air, is at once to increase the real danger, from exposure to noxious effluvia, and to divert attention from the true means of remedy and prevention.

Florence Nightingale:

The idea of “contagion”, as explaining the spread of disease, appears to have been adopted at a time when, from the neglect of sanitary arrangements, epidemics attacked whole masses of people, and when men had ceased to consider that nature had any laws for her guidance. Beginning with the poets and historians, the word finally made its way into scientific nomenclature, where it has remained ever since [...] a satisfactory explanation for pestilence and an adequate excuse for non-exertion to prevent its recurrence.

The current germ theory accounts for disease proliferation by both direct and indirect physical contact.* [21]

29.3.3 Influence on sanitary engineering reforms

In the early nineteenth century, the living conditions of industrialized cities in Britain were increasingly unsanitary. Population was moving in much faster than the infrastructure could support. For example, the population of Manchester doubled within a single decade, leading to overcrowding and a great increase in waste accumulation.* [22] The theory of miasma disease made sense to the sanitary reformers of the mid-19th century. Miasma explained why cholera and other diseases were epidemic in places where the water was undrained and very foul-smelling. As sanitary reform's engineering leader, London's Edwin Chadwick, asserted that “all smell is disease”, and he proposed that a change in the fundamental structure of sanitation systems was in order to combat increasing urban mortality rates. Chadwick asserted that the problem of epidemics of cholera and typhoid was directly related to urbanization, and he proposed that new, independent sewer systems should be connected to homes. Chadwick supported his proposal with reports from the London Statistical Society which showed dramatic increases in both morbidity and mortality rates since the beginning of urbanization in the early nineteenth century.* [22] Though Chadwick proposed reform on the basis of miasma theory, his proposals still contributed to sanitation improvements, such as preventing the reflux of noxious air from sewers back into houses by separate drainage systems in the sanitation designs, which incidentally led to decreased episodes of cholera and thus helped to support the theory.* [23]

The miasma theory was consistent with the observations that disease was associated with poor sanitation (and hence foul odours) and that sanitary improvements reduced disease; it was not consistent with the observations of microbiology however which led to the later germ theory of disease. The introduction of medical bacteriology in the 1870s and 1880s provided a challenge to the miasma theory, though consensus was not reached immediately; concerns over sewer gas, which was a major component of the miasma theory developed by Galen and brought to prominence by the Great Stink, led to continuing proponents of the theory who observed that sewers enclosed the refuse of the human bowel, which medical science had discovered could teem with typhoid, cholera, and other microbes.

The work of John Snow is notable for helping to make the connection between cholera and typhoid epidemics and contaminated water sources, which contributed to the eventual demise of miasma theory. During the cholera epidemic

of 1854, Snow traced high mortality rates among the citizens of Soho to a water pump in Broad Street. Snow convinced the local government to remove the pump handle, which resulted in a marked decrease in cases of cholera in the area. In 1857, Snow submitted a paper to the *British Medical Journal* which attributed high numbers of cholera cases to water sources that were contaminated with human waste. Snow used statistical data to show that citizens who received their water from upstream sources were considerably less likely to develop cholera than those who received their water from downstream sources. Though his research supported his hypothesis that contaminated water, not foul air, was the source of cholera epidemics, a review committee concluded that Snow's findings were not significant enough to warrant change, and they were summarily dismissed. Additionally, other interests intervened in the process of reform. Many water companies and civic authorities pumped water directly from contaminated sources such as the Thames to public wells, and the idea of changing sources or implementing filtration techniques was an unattractive economic prospect. In the face of such economic interests, reform was slow to be adopted.*[22]

Even though later disproven by the influence of *bacteria* and the discovery of *viruses*, the miasma theory helped make the connection between poor *sanitation* and disease. This caused public health reforms and encouraged cleanliness, which in Britain led to the legislation of Parliament which approved the Public Health Acts*[24] of 1848 and 1858 and the Local Government Act of 1858. The latter of these confers the power of instating investigations into the health and sanitary regulations of any town or place, upon the petition of residents or death rates exceeding the norm. Early medical and sanitary engineering reformers included Henry Austin, Joseph Bazalgette, Edwin Chadwick, Frank Forster, Thomas Hawksley, William Haywood, Henry Letheby, Robert Rawlinson, Sir John Simon and Thomas Wicksteed.*[25] These and later British regulatory improvements were reported in the United States as early as 1865.*[26]

Particularly notable to nineteenth century sanitation reform is the work of Joseph Bazalgette, chief engineer to London's Metropolitan Board of Works. Encouraged by the Great Stink, Parliament sanctioned Bazalgette to design and construct a comprehensive system of sewers which intercepted London's sewage and diverted it away from its water supply. The system helped purify London's water supply and saved the city from epidemics. In 1866, the last of the three great British cholera epidemics took hold in a small area of Whitechapel. However, the area was not yet connected to Bazalgette's system, and the confined area of the epidemic in London acted as testament to the efficiency of the system's design.*[2]

Years later, the influence of these sanitary reforms on Britain was described by Sir Richard Rogers:*[25]

London was the first city to create a complex civic administration which could coordinate modern urban services, from public transport to housing, clean water to education. London's County Council was acknowledged as the most progressive metropolitan government in the world. Fifty years earlier, London had been the worst slum city of the industrialized world: over-crowded, congested, polluted and ridden with disease...

The miasma theory did contribute to containing disease in urban settlements, but did not allow for a suitable approach to safe excreta reuse in agriculture to be adopted.*[27] It was one of the causes for abandoning the prevailing practice of collecting human excreta from urban settlements and reusing them in the surrounding farmland (nowadays referred to as the *ecosan* approach of "closing the loop" when done in a safe manner). Such *resource recovery* schemes were common in many European cities until the 19th century before the arrival of sewer-based *sanitation* systems.

Throughout the nineteenth century public health, sanitation and the influence of miasma became the main reasons for the controversial practice of *cremation*. The miasma theory stated that infectious diseases were spread by noxious gases emitted from decaying organic matter, which included decaying corpses. This public health argument for cremation faded along with the miasma theory.*[28]

29.3.4 From miasma to germ theory

Although the connection between germ and disease was proposed quite early, it was not until the late-1800s that the germ theory was generally accepted. The miasmatic theory was challenged by John Snow, suggesting that there was some means by which the disease was spread via a poison or morbid material (orig: *materies morbi*) in the water.*[29] He suggested this before and in response to an epidemic on Broad Street in central London in 1854.*[30] Because of the miasmatic theory's predominance among Italian scientists, the discovery in the same year by Filippo Pacini of the *bacillus* that caused the disease was completely ignored.

It was not until 1876 that Robert Koch proved that the bacterium *Bacillus anthracis* caused anthrax,*[31] which brought a definitive end to Miasma Theory.

In 1846, the Nuisances Removal and Diseases Prevention Act^{*} [24] was passed to identify whether the transmission of **Cholera** is by air or by water. The bill was used to encourage the owner to clean their dwelling and connect them to sewers.

Some years later in 1855, **John Snow** made a testimony against the Amendment to this bill that regularized air pollution of some industries. He claimed that:

That is possible; but I believe that the poison of the cholera is either swallowed in water, or got directly from some other person in the family, or in the room; I believe it is quite an exception for it to be conveyed in the air; though if the matter gets dry it may be wafted a short distance.^{*} [32]

At the same year, **William Farr**, who was then the major supporter of the Miasma Theory, issued a report to criticize the germ theory. Farr and the Committee wrote that:

After careful inquiry, we see no reason to adopt this belief. We do not feel it established that the water was contaminated in the manner alleged; nor is there before us any sufficient evidence to show whether inhabitants of that district, drinking from that well, suffered in proportion more than other inhabitants of the district who drank from other sources.^{*} [33]^{*} [34]

The more formal experiments on the relationship between germ and disease were conducted by **Louis Pasteur** between 1860 and 1864. He discovered the pathology of the **puerperal fever**^{*} [35] and the pyogenic vibrio in the blood, and suggested using **boric acid** to kill these microorganisms before and after confinement.

By 1866, eight years after the death of John Snow, William Farr publicly acknowledged that the miasma theory on the transmission of cholera was wrong, by his statistical justification on the death rate.^{*} [33]

29.4 See also


- Germ theory of disease

29.5 References

- [1] John M. Last, ed. (2007). "A Dictionary of Public Health" . Westminster College, Pennsylvania: Oxford University Press. lcontribution= ignored (help)
- [2] Halliday, Stephen (2001). "Death and Miasma in Victorian London: An Obstinate Belief" . *British Medical Journal*.
- [3] Linda Nash, *Inescapable Ecologies: A History of Environment, Disease, and Knowledge* (2007)
- [4] Suellen Hoy, *Chasing Dirt: The American Pursuit of Cleanliness* (1996) pp 104-13
- [5] Miasma in Webster Dictionary
- [6] 'Malouin, Paul-Jacques. "Miasma." The Encyclopedia of Diderot & d'Alembert Collaborative Translation Project. Translated by Jaclyn Assarian. Ann Arbor: Michigan Publishing, University of Michigan Library, 2004. Web. 1 April 2015. <<http://hdl.handle.net/2027/spo.did2222.0000.369>>. Trans. of "Miasme," Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers, vol. 10. Paris, 1765'
- [7] Miasma Analysis
- [8] Vitruvius, *De architectura* I.4.1, Latin text at LacusCurtius.
- [9] BRIEF HISTORY DURING THE SNOW ERA (1813–58)
- [10] Who was William Farr?
- [11] Development of the Germ Theory of Disease
- [12] The Invisible Giant
- [13] Valenčius, Conevery B. The Health of the Country: How American Settlers Understood Themselves and Their Land. New York: Basic Books, 2002. 115-117. Print.

- [14] (隋) 巢元方撰，曹赤電炳章圈點，《巢氏諸病源候論》，(台北：國立中國醫藥研究所，1996)，頁 30、47-51。
- [15] 牟重行，王彩萍，〈中國歷史上的「瘴氣」考釋〉，《國立臺灣師範大學地理研究報告》，(第 38 期，台北：國立臺灣師範大學地理學系，2003)，頁 25。
- [16] 牟重行，王彩萍，〈中國歷史上的「瘴氣」考釋〉，《國立臺灣師範大學地理研究報告》，(第 38 期，台北：國立臺灣師範大學地理學系，2003)，頁 25-26。
- [17] , Translated by Arthur Waley in *Chinese Poems*.
- [18] , 宋周去非，嶺外代答，卷十，276.
- [19] 龔勝生，〈2000 年來中國瘴病分布變遷的初步研究〉，《地理學報》，第 48 卷第 4 期，(西安：陝西師範大學中國歷史地理研究所，1993)，頁 305-312。
- [20] Baldwin, Peter C. "How Night Air Became Good Air, 1776-1930" in *Environmental History*, July 2003
- Cipolla, Carlo M. *Miasmas and disease: Public health and environment in the pre-industrial age*. Yale University Press, 1992. ISBN 0-300-04806-8.
- [21] The Invisible Ghost
- [22] Gill, Geoff (2000). "Cholera and the fight for Public Health Reform in Mid-Victorian England" . *Historian*.
- [23] Whorton, James (2001). "'The insidious foe'—sewer gas". *West J. Med.* **175** (6): 427–428. doi:10.1136/ewjm.175.6.427. PMC 1275984 . PMID 11733443.
- [24] "Sanitary Legislation. No. VII. Nuisances Removal and Diseases Prevention Acts Consolidation and Amendment Bill" . *Association Medical Journal*. **3** (131): 619–621. 6 July 1855. JSTOR 25496511.
- [25] SULAIR: British and Commonwealth Literary Studies
- [26] "EUROPEAN SANITARY REFORM.; The British Sanitary Legislation" . *The New York Times*. 31 July 1865. Retrieved 9 December 2016.
- [27] Bracken, P.; Wachtler, A.; Panesar, A.R.; Lange, J. (March 2007). "The road not taken: how traditional excreta and greywater management may point the way to a sustainable future" . *Water Science & Technology: Water Supply*. **7** (1): 219–227. doi:10.2166/ws.2007.025.
- [28] "USA." Encyclopedia of Cremation. Surrey: Ashgate Publishing, 2005. Credo Reference. Web. 17 September 2012.
- [29] <http://johnsnow.matrix.msu.edu/work.php?id=15-78-3A>
- [30] http://www.york.ac.uk/depts/maths/histstat/snow_map.htm
- [31] <http://www.sciencemuseum.org.uk/broughttolife/people/robertkoch.aspx>
- [32] Snow's Testimony
- [33] Competing Theories of Cholera
- [34] Report of the Committee on Scientific. Inquiries in Relation to the Cholera Epidemic
- [35] On the extension of the germ theory to the etiology of certain common diseases

29.6 Further reading

- Beasley, Brett (2015-09-30). "Bad Air: Pollution, Sin, and Science Fiction in William Delisle Hay's The Doom of the Great City (1880)". *The Public Domain Review*. **5** (18). .
- Sterner, Carl S. (2007). "A Brief History of Miasmatic Theory" (PDF). *Bulletin of the History of Medicine*. **22** (1948): 747.
- Thorsheim, Peter (2006). *Inventing Pollution: Coal, Smoke, and Culture in Britain since 1800*. Ohio University Press. ISBN 0-8214-1681-2.

29.7 External links

- [Prevailing theories before the germ theory](#)
- [Cholera theories](#)
- [Term definition](#)

Chapter 30

Milieu control

Milieu control is a term popularized by psychiatrist **Robert Jay Lifton** to describe tactics that control environment and human communication through the use of social pressure and group language; such tactics may include dogma, protocols, innuendo, slang, and pronunciation, which enables group members to identify other members, or to promote cognitive changes in individuals. Lifton originally used “milieu control” to describe brainwashing and mind control, but the term has since been applied to other contexts.*[1]

30.1 Background

Milieu control involves the control of communication within a group environment, that also may (or may not) result in a significant degree of isolation from surrounding society. When non-group members, or outsiders, are considered or potentially labeled as less valuable without basis for stated group-supported and group-reinforced prejudice, group members may have a tendency to then consider themselves as intellectually superior, which can limit alternate points of view, thus becoming a self-fulfilling prophecy in which group members automatically begin to devalue others and the intellect of others that are separate from their group, without logical rationale for doing so. Additionally, Milieu control “includes other techniques to restrict members' contact with the outside world and to be able to make critical, rational, judgments about information.”*[2]

30.2 See also

- Politico-media complex

30.3 References

- [1] A Bandura. 1982. The psychology of chance encounters and life paths. American Psychologist, Vol. 37 No. 7, July 1982
- [2] Dr. Lifton, Robert J.Thought Reform: Milieu Control. Retrieved on August 24, 2008. www.ferozegolwalla.com.

30.4 External links

- Robert Jay Lifton's eight criteria of thought reform as applied to the Executive Success Programs
- Attacks on Peripheral versus Central Elements of Self and the Impact of Thought Reforming Technique
- Cognitive Impairment in Thought Reform Environments
- International Cultic Studies Association

Chapter 31

Military Assistance Command, Vietnam – Studies and Observations Group

Military Assistance Command, Vietnam – Studies and Observations Group (MACV-SOG) was a highly classified, multi-service United States special operations unit which conducted covert **unconventional warfare** operations prior to and during the **Vietnam War**.

Established on 24 January 1964, the unit conducted strategic reconnaissance missions in the **Republic of Vietnam** (South Vietnam), the **Democratic Republic of Vietnam** (North Vietnam), **Laos**, and **Cambodia**; carried out the capture of enemy prisoners, rescued downed pilots, and conducted rescue operations to retrieve prisoners of war throughout Southeast Asia; and conducted clandestine agent team activities and **psychological operations**.

The unit participated in most of the significant campaigns of the Vietnam War, including the Gulf of Tonkin incident which precipitated increased American involvement, Operation Steel Tiger, Operation Tiger Hound, the Tet Offensive, Operation Commando Hunt, the Cambodian Campaign, Operation Lam Son 719, and the Easter Offensive. The unit was formally disbanded and replaced by the Strategic Technical Directorate Assistance Team 158 on 1 May 1972.

31.1 Foundation

For more details on the origins of the Southeast Asian conflict, see **Vietnam War**.

The Studies and Observations Group (aka SOG, MACSOG, and MACV-SOG) was a joint unconventional warfare task force created on 24 January 1964 by the **Joint Chiefs of Staff** as a subsidiary command of the **Military Assistance Command, Vietnam** (MACV). The unit would eventually consist primarily of personnel from the **United States Army Special Forces**, the **United States Navy SEALs**, the **United States Air Force**, the **Central Intelligence Agency** (CIA), and elements of the **United States Marine Corps Force Reconnaissance** units.

The Special Operations Group (as the unit was initially titled) was in fact controlled by the Special Assistant for Counterinsurgency and Special Activities (SACSA) and his staff at **the Pentagon**.^a This arrangement was necessary since SOG needed some listing in the MACV table of organization and the fact that MACV's commander, **General William Westmoreland**, had no authority to conduct operations outside territorial South Vietnam. This command arrangement through SACSA also allowed tight control (up to the presidential level) of the scope and scale of the organization's operations.^{*[1]} The mission of the organization was

“to execute an intensified program of harassment, diversion, political pressure, capture of prisoners, physical destruction, acquisition of intelligence, generation of propaganda, and diversion of resources, against the Democratic Republic of Vietnam.”^{*[2]}

These operations (OPLAN 34-Alpha) were conducted in an effort to convince **North Vietnam** to cease its sponsorship of the **communist insurgency in South Vietnam**. Similar operations had originally been under the purview of the CIA, which had carried out the emplacement of agent teams in North Vietnam using air drops and over-the-beach

insertions. Under pressure from **Secretary of Defense Robert S. McNamara**, the program, along with all other agency para-military operations, was turned over to the military in the wake of the disastrous **Bay of Pigs Invasion** operation in **Cuba**.^[3]

Colonel Clyde Russell (SOG's first commander) had difficulty in creating an organization with which to fulfill his mission since, at the time, United States Special Forces were unprepared either doctrinally or organizationally to carry it out.^[4]^b At this point the mission of the Special Forces was the conduct of guerrilla operations behind enemy lines in the event of an invasion by conventional forces, not in the conduct of agent, maritime, or psychological operations. Russell expected to take over a fully functional organization and assumed that the CIA (which would maintain a representative on SOG's staff and contribute personnel to the organization) would see the military through any teething troubles. His expectations and assumptions were incorrect.^[5] The contribution of the South Vietnamese came in the form of SOG's counterpart organization (which used a plethora of titles, finally ending with the Strategic Technical Directorate [STD]).

After a slow and shaky start, the unit got its operations underway. Originally, these consisted of a continuation of the CIA's agent infiltrations. Teams of South Vietnamese volunteers were parachuted into the north, but the majority were captured soon after their insertions. Maritime operations against the coast of North Vietnam picked up after the delivery of Norwegian-built "Nasty" Class Fast Patrol Boats to the unit, but these operations also fell short of expectations.

31.2 Gulf of Tonkin incident

Main article: **Gulf of Tonkin Incident**

On the night of 30/31 July 1964, four SOG vessels shelled two islands, Hon Me and Hon Ngu, off the coast of North Vietnam. This was the first time SOG vessels had attacked North Vietnamese shore facilities by shelling them from the sea. The following afternoon, the destroyer **USS Maddox (DD-731)** began an electronic intelligence-gathering mission along the coast of North Vietnam, in the **Gulf of Tonkin**. On the afternoon of 2 August, three **P 4-class torpedo boats** of the North Vietnamese Navy came out from Hon Me and attacked the **Maddox**. The American vessel was undamaged and the U.S. claimed that one of the attacking vessels had been sunk and that the others were damaged by U.S. carrier-based aircraft. On the night of 3/4 August, three SOG vessels shelled targets on the mainland of North Vietnam. On the night of 4 August, after being joined by the destroyer **USS Turner Joy (DD-951)**, **Maddox** reported to **Washington** that both ships were under attack by unknown vessels (assumed to be North Vietnamese).^[6]

This second reported attack led President **Lyndon B. Johnson** to launch **Operation Pierce Arrow**, an aerial attack against North Vietnamese targets on 5 August. Johnson also went to the **United States Congress** that same day and requested the passage of the Southeast Asia Resolution (better known as the **Gulf of Tonkin Resolution**) asking for the unprecedented authority to conduct military actions in Southeast Asia without a declaration of war.

Johnson's announcement of the incidents involving the destroyers did not mention that SOG vessels had been conducting operations within the same geographic area as the **Maddox** immediately before, and during, that cruise. Neither did he mention that on 1 and 2 August Laotian aircraft, flown by Thai pilots, had carried out bombing raids within North Vietnam itself or that a SOG agent team had been inserted into the same relative area and had been detected by the North Vietnamese.^[7] **Hanoi**, which may have assumed that all of these actions signaled an increased level of U.S. aggression, decided to respond (in what it claimed as its territorial waters).^c Thus, the three P-4s were ordered to attack the **Maddox**. The second incident, in which **Maddox** and **Turner Joy** were claimed to be attacked, never took place.^[8] Although some confusion reigned at the time of the second attack, the facts were clear to the administration by the time it went to Congress to obtain the resolution. When confronted by Senator **Wayne Morse** (who had discovered the existence of SOG's 34-Alpha raids), McNamara lied to him, stating "Our Navy played absolutely no part in, was not associated with, and was not aware of any South Vietnamese actions." Yet both **Commander in Chief, Pacific Command (CINCPAC)** and he were well aware of the possible connections, at least insofar as they might have existed in the minds of the Hanoi leadership.^[9] These events were not disclosed until the publication of the *Pentagon Papers* in 1970.

The last aspect of SOG's original missions consisted of **psychological operations** conducted against North Vietnam. The unit's naval arm picked up northern fishermen during searches of coastal vessels and detained them on **Cu Lao Cham Island** off **Da Nang**, South Vietnam (the fishermen were told that they were, in fact, still within their homeland).^[10]

The South Vietnamese crews and personnel on the island posed as members of a dissident northern communist



2 August 1964: A North Vietnamese P-4 under fire from Maddox

group known as the Sacred Sword of the Patriot League (SSPL), which opposed the takeover of the Hanoi regime by politicians who supported the People's Republic of China (PRC). The kidnapped fishermen were well fed and treated, but they were also subtly interrogated and indoctrinated in the message of the SSPL. After a two-week stay, the fishermen were returned to northern waters.

This fiction was supported by the radio broadcasts of SOG's "Voice of the SSPL", leaflet drops, and gift kits containing pre-tuned radios which could only receive broadcasts from the unit's transmitters. SOG also broadcast "Radio Red Flag," programming purportedly directed by a group of dissident communist military officers also within the north. Both stations were equally adamant in their condemnations of the PRC, the South and North Vietnamese regimes, and the U.S. and called for a return to traditional Vietnamese values. Straight news, without propaganda embellishment, was broadcast from South Vietnam via the *Voice of Freedom*, another SOG creation.* [11]

These agent operations and propaganda efforts were supported by SOG's air arm, the First Flight Detachment. The unit consisted of four heavily modified C-123 *Provider* aircraft flown by Nationalist Chinese aircrews in SOG's employ. The aircraft flew agent insertions and resupply, leaflet and gift kit drops, and carried out routine logistics missions for SOG.

31.3 *Shining Brass*

For more details on the communist logistical system in Laos, see *Ho Chi Minh Trail*.

On 21 September 1965 the Pentagon authorized MACSOG to begin cross-border operations within Laos in areas contiguous to the South Vietnam's western border.* [12] MACV had sought authority for the launching of such missions (Operation *Shining Brass*) since 1964 in an attempt to put boots on the ground in a reconnaissance role to observe, first hand, the enemy logistical system known as the *Ho Chi Minh Trail* (the Truong Son Road to the North Vietnamese).* d MACV, through the *Seventh Air Force*, had begun carrying out strategic bombardment of the logistical system in southern Laos in April (Operation *Steel Tiger*) and had received authorization to launch an all-Vietnamese

recon effort (Operation *Leaping Lena*) that had proven to be a disaster.* [13] U.S. troops were necessary and SOG was given the green light. In November the first American-led insertion was launched against target Alpha-1, a suspected truck terminus on Laotian Route 165, 15 miles inside Laos.* [14] The mission was deemed a success, but the operations in Laos were fraught with peril, and not just from the enemy. William H. Sullivan, U.S. ambassador to Laos, was determined that he would remain in control over decisions and operations that took place within the supposedly neutral kingdom.

The civil war that raged intermittently between the Communist *Pathet Lao* (supported by North Vietnamese troops) and the Royal Lao armed forces (supported by the CIA-backed *Hmong* army of General *Vang Pao* and the aircraft of the U.S. Air Force) compelled both sides to maintain as low a profile as possible.* *e* Hanoi was interested in Laos due only to the necessity of keeping its supply corridor to the south open. The U.S. was involved for the opposite reason. Both routinely operated inside Laos, but both also managed to keep their operations out of the limelight due to Lao's apparent neutrality.* *f*

Ambassador Sullivan had the unenviable task of juggling the bolstering of the inept Lao government and military, the CIA and its clandestine army, the U.S. Air Force and its bombing campaign, and now the incursions of the American-led reconnaissance teams of SOG.* [15] His limitations on SOG's operations (depth of penetration, choice of targets, length of operations, etc.) led to immediate and continuous enmity between the embassy in *Vientiane* and the commander and troops of SOG, who promptly labelled Sullivan the "Field Marshal." * [16] The ambassador responded in kind.

Regardless, MACSOG began a series of operations that would continue to grow in size and scope over the next eight years. The Laotian operations were originally run by a Command and Control (C&C) headquarters located at Da Nang. The teams, usually three Americans and three to 12 indigenous mercenaries, were launched from Forward Operating Bases (FOBs) located in the border areas (originally at Kham Duc, Kontum, and Khe Sanh).* [17] After in-depth planning and training, a team was helilifted over the border by aircraft provided by the U.S. Marine Corps (who operated in the I Corps area) or by dedicated South Vietnamese *H-34* Kingbee helicopters of the 219th Squadron, which would remain affiliated with MACSOG for its entire history.* [18] The team's mission was to penetrate the target area, gather intelligence, and remain undetected as long as possible. Communication was maintained with a Forward Air Control (FAC) aircraft, which would provide liaison with Air Force fighter-bombers if the necessity, or the opportunity to strike lucrative targets, arose. The FAC was also the lifeline through which the team would communicate with its FOB and through which it could call for extraction if it became compromised.

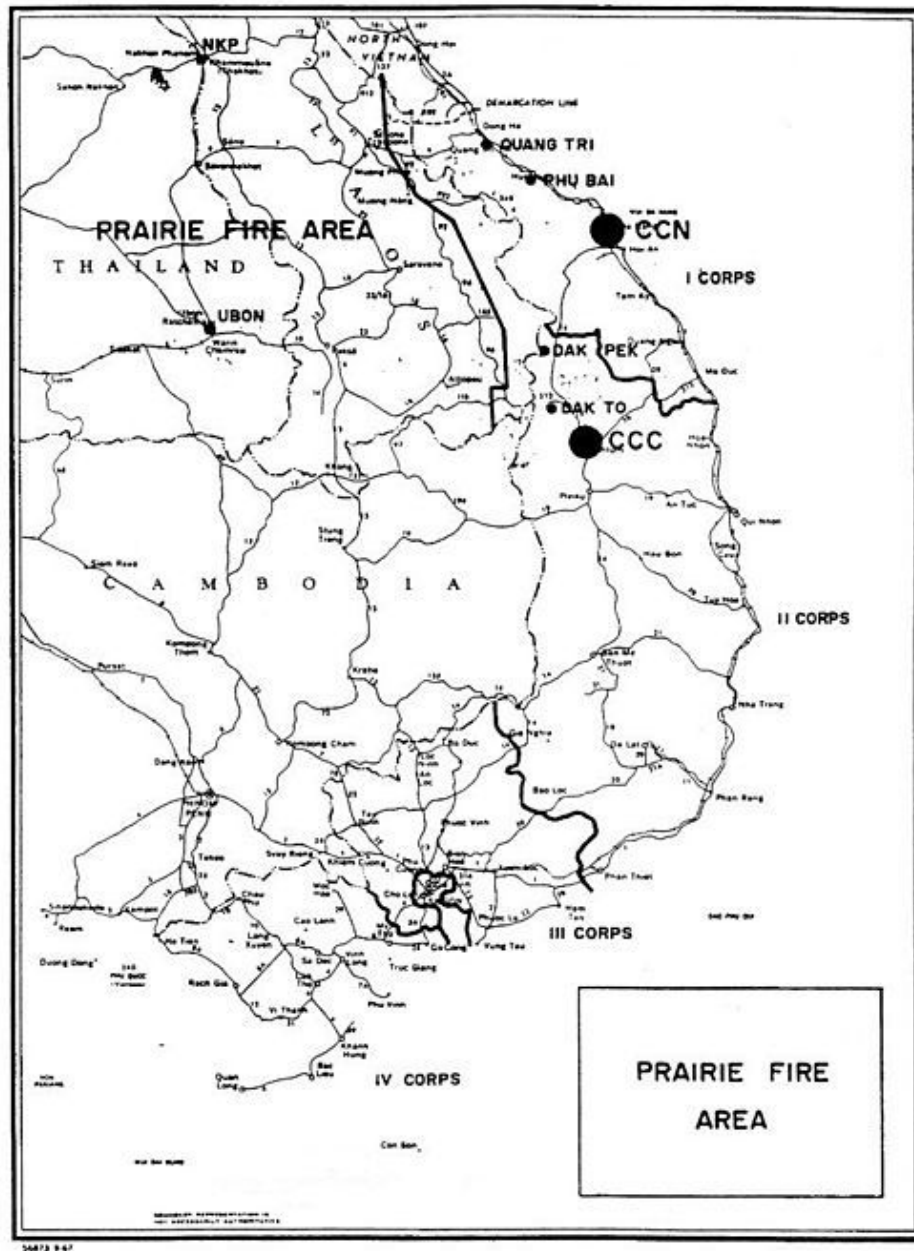
By the end of 1965, MACSOG had shaken itself out into Operational Groups commanded from its *Saigon* headquarters.* [19] These included Maritime Operations, which continued harassment raids and support for psychological operations (via kidnapped fishermen); Airborne Operations, which continued to insert agent teams and supplies into the north; Psychological Operations, which continued its "black" radio broadcasts, leaflet and gift kit drops, and running the operation at Cu Lao Cham; the new *Shining Brass* program; and Air Operations, which supported the others and provided logistical airlift. Training for SOG's South Vietnamese agents, naval action teams, and indigenous mercenaries (usually *Nùng* or *Montagnards* of various tribes) was conducted at the ARVN airborne training center (Camp Quyet Thang) located at Long Thanh, southeast of Saigon. Training for the U.S. personnel assigned to recon teams (RTs) was conducted at Kham Duc.

31.4 *Daniel Boone*

For more details on the communist logistical system in Cambodia, see *Sihanouk Trail*.

During 1966 and 1967 it became obvious to MACV that the North Vietnamese were using neutral *Cambodia* as a part of their logistical system, funneling men and supplies to the southernmost seat of battle. The unknown factor was the how much use the enemy was making of Cambodia. The answer shocked even the most hardened intelligence analysts. Prince *Norodom Sihanouk*, desperately trying to balance the threats facing his nation, had allowed Hanoi to set up a presence in Cambodia. Although the extension of Laotian Highway 110 into Cambodia in the tri-border region was an improvement to its logistical system, North Vietnam was now unloading communist-flagged transports in the port of *Sihanoukville* and simply trucking its supplies to its Base Areas on the eastern border.* *g*

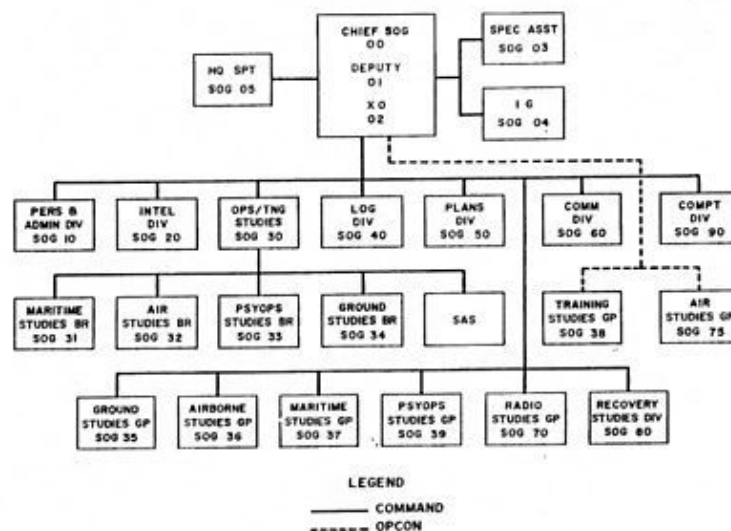
In April 1967 MACSOG was ordered to commence Operation *Daniel Boone*, a cross-border recon effort in Cambodia. Both SOG and the 5th Special Forces Group had been preparing for just such an eventuality. The 5th had gone so far as to create Projects *Sigma* and *Omega*, units based on SOG's *Shining Brass* organization, which had been conducting in-country recon efforts on behalf of the Field Forces, awaiting authorization to begin the Cambodian operations. A turf war now raged between the 5th and SOG over missions and manpower.* [20] The Joint Chiefs decided in favor of MACSOG, since it already successfully conducted covert cross-border operations. Operational control of *Sigma*



Shining Brass/Prairie Fire Area of Operations, 1969

and *Omega* was handed over to SOG.* [20]

The first mission was launched in September and construction was begun on a new C&C to be located at Ban Me Thuot, in the Central Highlands. The RTs inserted into Cambodia faced even more restrictions than those in Laos.



MACV-SOG Organization

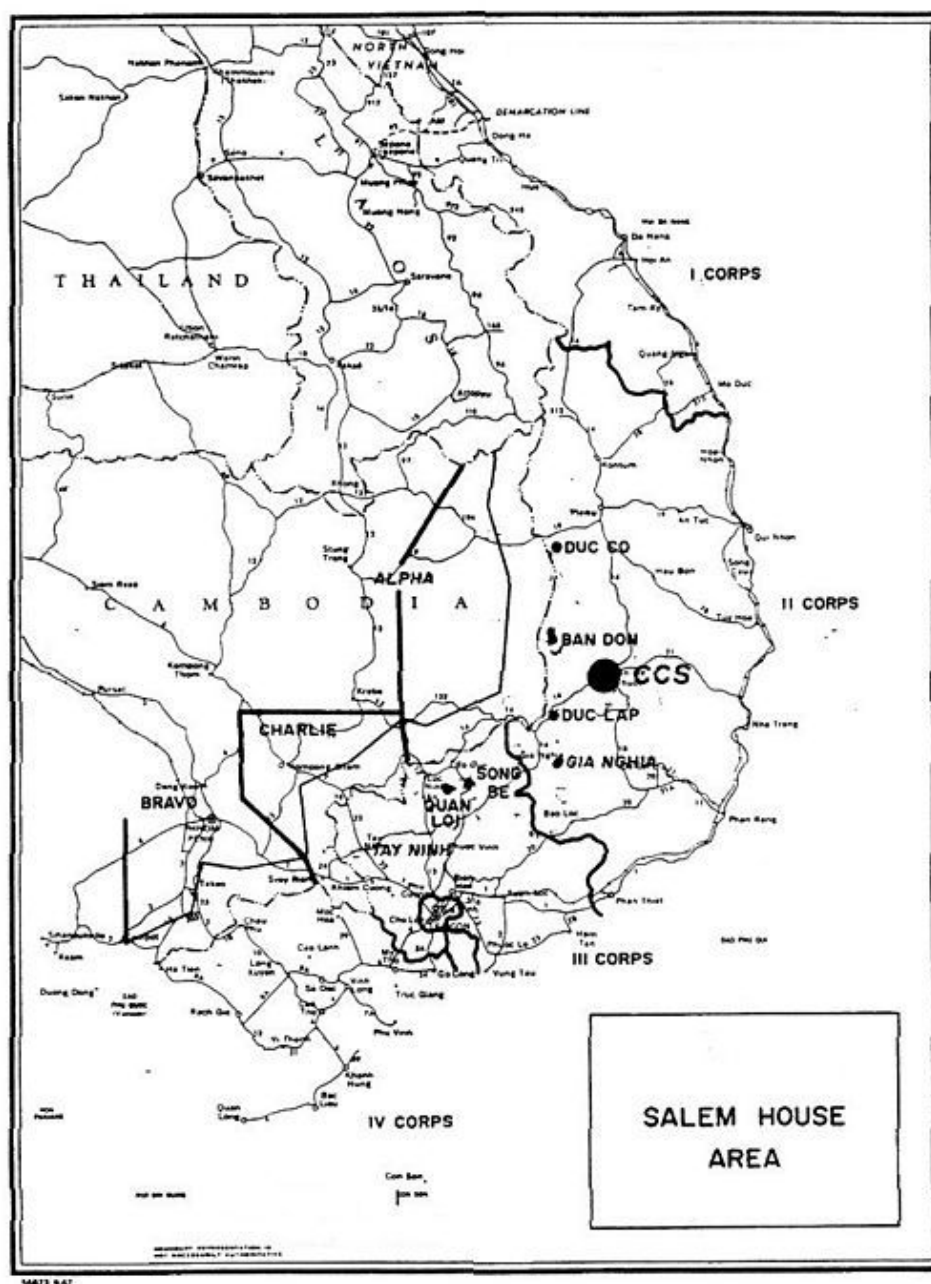
Initially, they had to cross the border on foot, had no tactical air support (either helicopters or aircraft), and were not to be provided with FAC coverage. The teams were, therefore, to rely on stealth and were usually smaller in size than those that operated in Laos.^[21]

Daniel Boone was not the only addition to SOG's size and missions. During 1966, the Joint Personnel Recovery Center (JPRC) was initiated. The mission of the JPRC was to collect and coordinate information on POWs, escapees and evadees, to launch missions to free U.S. and allied prisoners, and to conduct post-search and rescue (SAR) operations when all other efforts had failed. SOG provided the capability to launch *Brightlight* rescue missions anywhere in Southeast Asia at a moments notice.^{*h}

The Air Operations Group had been augmented in September 1966 by the addition of four specially-modified **MC-130E Combat Talon** (deployed under *Combat Spear*) aircraft, officially the 15th Air Commando Squadron, which supplemented the C-123s (*Heavy Hook*) of the First Flight Detachment already assigned to SOG. Another source of aerial support came from the **CH-3 Jolly Green Giant** helos of D-Flight, 20th **Special Operations Squadron** (callsign *Pony Express*), which had arrived at **Nakhon Phanom Royal Thai Air Force Base** during the year. These helicopters had been assigned to conduct operations in support of the CIA's clandestine operations in Laos and were a natural for assisting SOG in the *Shining Brass* area. When helicopter operations were finally authorized for *Daniel Boone*, they were provided by the dedicated support of the Huey gunships and transports of the U.S. Air Force's 20th SOS (callsign *Green Hornets*).

MACSOG reconnaissance teams were also bolstered by the creation of exploitation forces, which could either support the teams in time of need, or launch their own raids against the trail. They consisted of two (later three) *Haymaker* battalions (which were never used) divided into company-sized *Hatchet* forces which were, in turn, sub-divided into *Hornet* platoons. The commanders and non-commissioned officers of these forces were American personnel, usually assigned on a temporary duty basis in "Snakebite" teams from the 1st Special Forces Group on **Okinawa**.

By 1967, MACSOG had also been given the mission of supporting the new *Muscle Shoals* portion of the electronic and physical barrier system under construction along the **Demilitarized Zone (DMZ)** in I Corps. SOG recon teams were tasked with reconnaissance and the hand emplacement of electronic sensors both in the western DMZ (*Nickel Steel*) and in southeastern Laos.^[22]



The Daniel Boone/Salem House area of operations, 1969

Due to the disclosure of the cover name *Shining Brass* in an American newspaper article, SOG decided that new cover designations were necessary for all of its operational elements. The Laotian cross-border effort was renamed

Prairie Fire and it was combined with *Daniel Boone* in the newly created Ground Studies Group. All operations conducted against North Vietnam were now designated *Footboy*. These included *Plowman* maritime missions, *Humidor* psychological operations, *Timberwork* agent operations, and *Midriff* air missions.

Never happy with its long-term agent operations in North Vietnam, SOG decided to initiate a new program whose missions would be shorter in duration, conducted closer to South Vietnam, and carried out by smaller teams. Every effort would also be expended to retrieve the teams when their missions were accomplished. This was the origin of STRATA, the all-Vietnamese Short Term Roadwatch and Target Acquisition teams. After a slow initial start, the first agent team was recovered from the north. Following missions were plagued with difficulties, but, after additional training, the team's performance improved dramatically.* [23]

31.5 Black year – 1968

For more details on the struggle in I Corps, see *Battle of Khe Sanh*.

For more details on the NVA/VC offensive, see *Tet Offensive*.

1968 was a black year, not only for MACV but for MACSOG as well. The year saw not only the launching of the largest North Vietnamese/Viet Cong offensive thus far in the conflict, but the utter collapse of SOG's northern operations. Although the *Tet Offensive* was contained and rolled back, and although significant casualties were inflicted upon the enemy, the mood of the American people and government had turned irrevocably against an open-ended commitment by the United States. For most of the year MACSOG's operations centered around in-country missions in support of the Field Forces. Since the enemy had come out from his cover and launched conventional operations, the U.S. and South Vietnam lost no opportunity in engaging them. General Westmoreland, encouraged by the Joint Chiefs of Staff, requested 200,000 more troops, under the stipulation that they would be used to conduct cross-border operations to pursue his reeling foe.* [24] This was the logical military move at this point in the conflict, but it was already too late.

Instead, President Johnson sought a way out of the commitment that he had originally escalated. Politically, this was a little late in coming, but Washington had finally woken to the dire predicament it found itself embroiled in. Johnson attempted to get Hanoi to reopen serious peace negotiations and the carrot in this attempt was the cessation of all U.S. operations against North Vietnam north of the 20th parallel.* [25] Hanoi had only sought an end to the air campaign against the north (*Operation Rolling Thunder*), but Johnson went one further by calling a halt to all northern operations, both overt and covert. This order effectively ended MACSOG's agent team, propaganda, and aerial operations.* [26]

In reality, for MACSOG, the point was moot. Suspicions abounded within the organization that *Operation Timberwork* had been penetrated by communist *dich van* agents.* [27] The intelligence returns from the northern agent teams had been strangely lax and more than three-quarters of the agents inserted had been captured either during or not long after their arrival. The fact that SOG had slavishly followed the CIA's failed formula for three years was not considered a contributing factor. The unit was more concerned over Washington's continuous rejection of one of the original goals of the operation, the formation of a resistance movement by possible dissident elements within North Vietnam.* [28] Washington's stated goal in the conflict was a free and viable South Vietnam, not the overthrow of the Hanoi regime. The conundrum was what would happen if the program had succeeded. The best possible outcome would have been a repeat of the ill-fated Hungarian uprising of 1956, brutally crushed by the *Soviet Union*, and about which the U.S. could do nothing.

Some American writers on the subject (including many ex-SOG personnel) blamed the failure of the operations on the penetration of the unit by enemy spies – a claim not entirely unsupported by fact.*i Others, however, laid more of the blame on the operational ineptitude of SOG, which simply continued to repeat a failed formula.*j Changes to the infiltration program (in the form of the diversionary *Operation Forae*), spurred by suspicions at headquarters, had come only as late as 1967.* [29]

The security apparatus of North Vietnam had decades in which to learn to cope with not only the CIA's program, but with the unconventional and covert operations of its French predecessors. The CIA had been loath to conduct such operations in the north, since similar operations in the Soviet Union, Eastern Europe, and the PRC had been abject failures and North Vietnam was considered an even tougher target to penetrate.* [30]* [31]

North Vietnamese security forces simply captured a team, turned its radio operator, and continued to broadcast as though nothing had happened. Supplies and reinforcements were requested, parachuted in to the requesting team's location, and were likewise captured. During the period 1960–1968 both the CIA and MACSOG dispatched 456



*North Vietnamese troops on the **Ho Chi Minh** trail in Laos, photographed by a hidden SOG recon team*

South Vietnamese agents to either their deaths or long incarcerations in northern prisons.* [32] Hanoi continued this process year after year, learning SOG's operational methods and bending them to its purpose. In the end, it was running one of the most successful counterintelligence operations of the post-**Second World War** period.

31.6 *Commando Hunt*

For more details on the aerial interdiction effort in southeastern Laos, see *Operation Commando Hunt*.
For more details on the electronic sensor system, see *Operation Igloo White*.

With the deflation of its northern operations (although the JCS demanded that SOG retain the capability of reinitiating them), SOG concentrated its efforts on supporting *Commando Hunt*, the Seventh/Thirteenth Air Force's anti-infiltration campaign in Laos. By 1969 the Ground Studies Group was running its operations from C&Cs at Da Nang for operations in southeastern Laos and at Ban Me Thuot for its Cambodian operations. That year they were joined by a new C&C at Kontum, for operations launched into the triborder region of the *Prairie Fire* and the northern area of *Daniel Boone*, which was renamed *Salem House* that year. Each of the C&Cs was now fielding battalion-size forces, and the number of missions rose proportionately.

Command and Control North (CCN), commanded by a lieutenant colonel, used 60 recon teams and two exploitation battalions (four companies of three platoons). Command and Control Central (CCC), also commanded by a lieutenant colonel, used 30 teams and one exploitation battalion. During 1969 404 recon missions and 48 exploitation force operations were conducted in Laos.*[33] To give an example of the cost of such operations, during the year 20 Americans were killed, 199 wounded, and nine went missing in the *Prairie Fire* area. Casualties among the Special Commando Units (SCUs – pronounced Sues), as the indigenous mercenaries were titled, were: 57 killed, 270 wounded, and 31 missing.*[34] Command and Control South (CCS), also commanded by a lieutenant colonel, consisted of 30 teams and an exploitation battalion. Since the use of exploitation forces was forbidden in Cambodia, these troops were utilized in securing launch sites, providing installation security, and conducting in-country missions. During the year, 454 reconnaissance operations were conducted in Cambodia.*[35]

The teams were ferried into action by the H-34 Kingbees of the South Vietnamese 219th Helicopter Squadron and assorted U.S. Army aviation units in the *Prairie Fire* area, and by the U.S. Air Force helos of the *20th Special Operations Squadron* in the *Salem House* area. By the end of 1969, SOG was authorized 394 U.S. personnel, but it is useful to compare those numbers to the actual strengths of the operational elements. There were 1,041 Army, 476 Air Force, 17 Marine Corps, and seven CIA personnel assigned to those units. They were supported by 3,068 SCUs, and 5,402 South Vietnamese and third-country civilian employees, leading to a total of 10,210 military personnel and civilians either assigned to or working for MACSOG.*[36]

The mission of the Ground Studies Group was to support the sensor-driven *Operation Commando Hunt*, which saw the rapid expansion of the bombing of the Ho Chi Minh trail. This was made possible by the close-out of *Rolling Thunder*, which freed up hundreds of aircraft for interdiction missions. Intelligence for the campaign was supplied by both the recon teams of MACSOG and by the strings of air-dropped electronic sensors of *Operation Igloo White* (formerly *Muscle Shoals*), controlled from Nakhon Phanom.*k 1969 saw the apogee of the bombing campaign, when 433,000 tons of bombs were dropped on Laos.*[37] SOG supported the effort with ground reconnaissance, sensor emplacement, wiretap, and *bomb damage assessment* missions. The cessation of the bombing of the north also freed the North Vietnamese to reinforce their anti-aircraft defenses of the trail system and aircraft losses rose proportionately.

By 1969, the North Vietnamese had also worked out their doctrine and techniques for dealing with the recon teams. Originally, the communists had been caught unprepared and had been forced to respond in whatever haphazard manner local commanders could organize. Soon, however, an early warning system was created by placing radio-equipped air watch units within the flight paths between the launch sites and Base Areas. Within the Base Areas, lookouts were placed in trees and platforms to watch likely landing zones while the roads and trails were routinely swept by security forces. The communists also began to organize and develop specialized units that would both drive and then fix the teams so that they could be destroyed. By 1970, they had created a layered and effective system, and SOG recon teams found their time on the ground both shortened and more dangerous. The mauling or wiping out of entire teams began to become a less uncommon occurrence.*[38]

31.7 Laos and Cambodia

For more details on the conflict in Cambodia, see *Cambodian Civil War*.
For more details on the conflict in Laos, see *Laotian Civil War*.
For more details on the U.S./ARVN incursion, see *Cambodian Campaign*.
For more details on the ARVN incursion in Laos, see *Operation Lam Son 719*.

Since his election in 1968, President **Richard M. Nixon** had been seeking a negotiated settlement to the Vietnam War. In 1970, he saw an opportunity to buy time for the Saigon government during the phased withdrawal of U.S. troops that began in the previous year. He also sought to convince Hanoi that he meant business. That opportunity was provided by the overthrow of Cambodia's Prince Sihanouk by the pro-American **General Lon Nol**.^{*[39]}

Nixon had escalated U.S. involvement in Cambodia by authorizing the secret **Operation Menu** bombings and by the time of Sihanouk's ouster, the program had been in operation for 14 months.^{*[40]} Lon Nol promptly ordered North Vietnamese personnel out of the country. North Vietnam responded with an invasion of the country launched at the explicit request of the Khmer Rouge following negotiations with **Nuon Chea**. Nixon then authorized **Operation Rockcrusher**, a series of incursions by U.S. and South Vietnamese forces that began on 30 April.^{*[41]} With intelligence on communist Base Areas in eastern Cambodia gleaned from MACSOG, huge stockpiles of North Vietnamese arms, ammunition, and supplies were overrun and captured. In May, **Operation Freedom Deal**, a continuous aerial campaign against the North Vietnamese/Viet Cong and the **Khmer Rouge** was initiated.^{*[42]} SOG recon teams in Cambodia now had all the air support that they needed.

As a result of U.S. political reaction, on 29 December the **Cooper-Church Amendment** was passed by Congress, prohibiting participation by U.S. ground forces in any future operations in either Cambodia or Laos. U.S. participation in Cambodian operations (which were already being turned over to all-Vietnamese teams) ended on 1 July 1970 and the same stipulation was to apply in Laos no later than 8 February 1971 (the only qualifications to the restrictions, in both operational areas, were in case of either POW rescue missions or aircraft crash site inspections).^{*[43]} Although unknown to the U.S. public, many MACSOG veterans participated in **Operation Kingpin**, the Son Tay POW camp raid carried out in North Vietnam on 21 November 1970.^{*[44]} The deputy commander of the joint rescue force was Colonel **Arthur "Bull" Simons**, who had created SOG's cross-border effort in 1965.

By 1971 the U.S. was steadily withdrawing from Southeast Asia. As a test of **Vietnamization**, Washington decided to allow the South Vietnamese to launch **Operation Lam Son 719**, the long-sought incursion into Laos whose aim would be the cutting the **Ho Chi Minh Trail**. MACV and the South Vietnamese had been planning just such an operation as far back as August 1964, but the concept was continuously turned down due to the fallout that would have been incurred by the invasion of supposedly "neutral" Laos. The Laotian government (supported by Ambassador Sullivan and the State Department) was adamantly opposed to such an operation. On 8 February, 16,000 (later 20,000) South Vietnamese troops, backed by U.S. helicopter and air support, rolled into Laos along Route 9 and headed for the communist logistical hub at **Tchepone**.^{*[45]} Unlike the Cambodian incursion, however, the North Vietnamese stood and fought, gradually mustering 60,000 troops. By 25 March, the South Vietnamese forces retreated. Ironically, MACSOG's role in the operation was only peripheral. Recon teams conducted diversionary operations prior to the invasion and helped cover the South Vietnamese withdrawal, but they were otherwise forbidden from participation in the very operation that both MACSOG and MACV had come to consider its *raison d'être*.^{*[46]}

In Laos, the North Vietnamese cleared their logistical corridor to the west for security reasons and increased their aid and support for the **Pathet Lao**. Fighting that once was seasonal became continuous and conventional.^{*[47]} The **Cambodian Civil War** would escalate with the PRC backed **Khmer Rouge** (also backed by the exiled Sihanouk), fighting Lon Nol's central government.^{*[48]} Following US withdrawal from Indochina, its allies in Laos and Cambodia would collapse to the North Vietnamese backed forces.

31.8 Withdrawal

For more details on the PAVN offensive of 1972, see **Easter Offensive**.

For more details on the U.S. aerial campaign, see **Operation Linebacker**.

For more details on the U.S. aerial offensive of December 1972, see **Operation Linebacker II**.

For more details on the final NVA offensive of 1975, see **Ho Chi Minh Campaign**.

The American withdrawal from South Vietnam began to directly affect MACSOG only in 1972. Although U.S. personnel were forbidden to conduct operations in either Laos or Cambodia, its teams of mercenary SCUs continued those operations (in the newly renamed *Phu Dung/Prairie Fire* and *Thot Not/Salem House* areas). The organization did, however, maintain its strength in U.S. personnel, who continued to conduct in-country missions. It was also continuously tasked by the JCS with maintaining forces in readiness to once again take up northern operations if called upon to do so.

The *Nguyen Hue Offensive*, launched by North Vietnamese forces on 30 March 1972 (called the **Easter Offensive** in

the West), made cross-border operations irrelevant.^{*1} As with Tet, all of MACSOG/STD's efforts were concentrated on in-country missions to support the Field Forces.

In late March 1971, when the 5th Special Force Group was redeployed to the U.S., the Command and Control elements were renamed Task Force Advisory Elements (TF1AE, TF2AE and TF3AE). They originally consisted of 244 U.S. and 780 indigenous personnel each, but they were quickly drawn down by the elimination of the exploitation forces.^{*[49]} For SOG, Vietnamization was finally nigh. On 1 May 1972, the unit was reduced in strength and renamed the Strategic Technical Directorate Assistance Team 158 (STDAT-158).^{*[50]} The Ground Studies Group was disestablished and replaced by the Liaison Service Advisory Detachments. SOG's air elements stood down for redeployment, the JPRC was turned over to MACV and redesignated the Joint Casualty Resolution Center, while the psychological operations personnel and installations were turned over to either the STD or JUSPAO.^{*[51]}

The function of STDAT-158 was to assist the STD in a complete takeover of SOG's operations.^{*[52]} The operational elements had already been absorbed and were expanded by the inclusion of troops from the now-disbanded South Vietnamese Special Forces. The task of the American personnel was to provide technical support (in logistics, communications, etc.) and advice to the STD.^{*[53]} This the unit did until its disbandment on 12 March 1973.^{*[54]} The South Vietnamese General Staff, strapped for cash and equipment in the final stand-down period, never used the STD in a strategic reconnaissance role. Instead, the STD's units were launched on in-country missions until the dissolution of their parent organization in March 1973.

In January 1973, President Nixon ordered a halt to all U.S. combat operations in South Vietnam and, on the 27th of that month, a peace accord was signed by the belligerent powers in Paris. On 21 February, a similar accord was signed on Laos, ending the bombing of that country and instituting a cease fire. On the 29th, MACV was disestablished and remaining U.S. troops began leaving the south. On 14 August the U.S. Air Force ceased its bombing of Cambodia, bringing all military actions by the U.S. in Southeast Asia to an end.

31.9 Recognition

The U.S. military (and MACSOG personnel) kept tight security over knowledge of the unit's operations and existence until the early 1980s. Although there had been some small leaks by the media during the conflict, they were usually erroneous and easily dismissed.^{*[55]} More specific was the release of documents dealing with the early days of the operation in the *Pentagon Papers* and by the testimony of ex-SOG personnel during congressional investigations into the bombing campaigns in Laos and Cambodia in the early 1970s.^{*[56]} Historians interested in the unit's activities had to wait until the early 1990s, when MACSOG's Annexes to the annual MACV Command Histories and a Pentagon documentation study of the organization were declassified for the *Senate Select Committee on POW/MIA Affairs'* hearings on the *Vietnam War POW/MIA issue*.^{*[57]}

One early source of information (if one read between the lines) were the citations issued for the award of the *Medal of Honor* to MACSOG personnel (although they were never recognized as such).^{*[58]} One USAF helicopter pilot, two U.S. Navy SEALs, one U.S. Army medic, and nine *Green Berets* earned the nation's highest award on SOG operations:

- Staff Sergeant Roy P. Benavidez (who had to wait until he received his award from President Ronald Reagan)
- Staff Sergeant Jon Cavaiani
- First Lieutenant James P. Fleming (USAF 20th Special Operations Squadron)
- First Lieutenant Loren D. Hagen (posthumous), CCN/TF1AE
- Sergeant First Class Robert L. Howard (awarded on his third separate recommendation)
- Specialist 5 John J. Kedenburg (posthumous)
- Staff Sergeant Franklin D. Miller (5th Special Forces Group)
- Lieutenant Thomas R. Norris (Navy SEAL)
- Sergeant Gary Rose (Army medic)
- First Lieutenant George K. Sisler (posthumous)
- Engineman Second Class Michael E. Thornton (Navy SEAL), STDAT-158

- Sergeant First Class Fred W. Zabitosky

23 other members of the unit received the *Distinguished Service Cross*, the nation's second highest award for valor. On 4 April 2001, the U.S. Army officially recognized the bravery, integrity, and devotion to duty of its covert warriors by awarding the unit a *Presidential Unit Citation* during a ceremony at Fort Bragg, North Carolina, the home of U.S. Army Special Forces.

31.10 Technology

- McGuire rig
- Fulton surface-to-air recovery system

31.11 In popular culture

- The Studies and Observations Group make an appearance in Francis Ford Coppola's film *Apocalypse Now* following S.O.G operatives on the hunt for a rogue special forces colonel taking refuge in Cambodia.
- The Studies and Observations Group make an appearance in the 2010 Activision first-person shooter video game title *Call of Duty: Black Ops* being one of the main playable factions in the story line as well as a playable multiplayer faction.

31.12 See also

- North Vietnamese invasion of Laos
- Central Intelligence Agency's Special Activities Division
- Lauri Törni, aka Major Larry Thorne, who was killed in a 1965 MACV-SOG mission

31.13 Footnotes

1. ^a These officers included Major Generals Victor H. Krulak, USMC (1962–1964), Rollen H. Anthis, USAF (1964–1966), William R. Peers, USA (1966–1967), William E. DePuy, USA (1967–1969), John F. Freund, USA (1969–1970), and Brigadier Generals Donald D. Blackburn, USA (1970–1971), and Leroy J. Manor, USAF (1971–1973).
2. ^b The commanders of SOG were Colonels Clyde Russell (1964–1965), Donald Blackburn (1965–1966), John Singlaub (1966–1968), Stephen Cavanaugh (1968–1970), and John Sadler (1970–1972), all of whom were U.S. Army Special Forces officers.
3. ^c The North Vietnamese claimed a 12-mile reach for its territorial waters. *Maddox* was instructed not to approach closer than eight miles from the coast and four miles from offshore islands. It is instructive that similar patrols off the coast of the PRC were not allowed to approach within 15 miles of the coast or 12 miles from offshore islands.* [59]
4. ^d The only book-length history of the trail system remains John Prados' *The Blood Road*. Information can also be gleaned from *Victory in Vietnam*, the official Vietnamese military history of the conflict.
5. ^e Vang Pao and his troops kept up the fight against the People's Army of Vietnam (PAVN) in northeastern Laos. In the south, Lao irregular forces were supported by CIA-trained Thai Police Aerial Reconnaissance Unit (PARU) forces, which would number about 18,000 by the conflicts end.
6. ^f Two histories of the events in Laos are Roger Warner's *Shooting at the Moon* and Conboy & Morrison's *Shadow War*.

7. ^{^g} The high wire act maintained by Sihanouk and his relationship with the North Vietnamese is described in William Shawcross' *Sideshow** [60]
8. ^{^h} A thorough description of the history of the JPRC is found in George Veith's *Code-Name BRIGHTLIGHT*.
9. ^{^i} This view is supported by Sedgwick Tourison in his *Secret Army, Secret War* and by MACSOG veteran John Plaster.
10. ^{^j} These authors include Kenneth Conboy and Dale Andrade in their *Spies and Commandos* and Dr. Richard Shultz.
11. ^{^k} *Commando Hunt* and SOG's role in it are described in detail in Bernard Nalty's *War Against Trucks*, the official Air Force history of the campaign.
12. ^{^l} The Easter Offensive is well-described in Dale Andrade's *Trial By Fire*.

31.13.1 Notes

1. ^{^A} Dr. Moïse's account should be compared to the official Navy version, which was essentially the one given to Congress. See Edward Marolda and Oscar Fitzgerald, *The United States Navy and the Vietnam Conflict*, Vol. 2: *From Military Assistance to Combat, 1959–1965*. Washington DC: U.S. Naval Historical Center, 1986
2. ^{^B} See also interview of John Singlaub by Richard Shultz in *Military Assistance Command, Vietnam Studies and Observations Group* CD ROM compiled by Steve Sherman, Houston TX: Radix Press, 2002, pp. 16–19, 50–51.

31.14 References

- [1] MACSOG Documentation Study, Appendix B, pp. 354–355
- [2] Annex A to MACV Command History, 1964, p. A–1
- [3] Colby 1978
- [4] Shultz 1999, pp. 42–48
- [5] MACSOG Documentation Study, Annex N to Appendix B, B–n–4–10
- [6] Moïse 1996, pp. 73–93* A
- [7] Moïse 1996, pp. 67–68
- [8] Moïse 1996, pp. 106–142
- [9] McNamara & VanDeMark 1995, p. 137
- [10] MACSOG Documentation Study, Annex A to Appendix C, pp. 21–81
- [11] Shultz 1999, pp. 148–154.
- [12] MACV Command History 1965, Annex N, N–VIII–4
- [13] MACSOG Documentation Study, Appendix D, p. 11–15
- [14] Maitland & McInerney 1983, pp. 123–128
- [15] Shultz 1999, pp. 214–215, 226–228
- [16] Singlaub & McConnell 1991, p. 311
- [17] MACV Command History 1965, Annex N, N–VIII–8
- [18] MACV Command History 1966, Annex M, M–III–2–2
- [19] MACV Command History 1966, Annex M, M–I–A–1
- [20] MACSOG Documentation Study, Annex H to Appendix C, p. 11

- [21] Annex G to MACV Command History, 1967, G–IV–4
- [22] Van Staaveren 1993, pp. 255–283
- [23] Conboy & Andrade 2000, pp. 187–196
- [24] Karnow 1983, pp. 549–551
- [25] Dougan & Weiss 1983, pp. 136–141
- [26] MACSOG Documentation Study, Appendix C, pp. 99–100* B
- [27] Plaster, John L. (1997). *SOG*. New York: Simon and Schuster. pp. 221–222.
- [28] Shultz 1999, pp. 95–99
- [29] MACSOG Documentation Study, Appendix C, p. 79
- [30] Conboy & Andrade 2000, pp. 80–84
- [31] Tourison 1995, pp. 100–101
- [32] Tourison 1995, pp. 331–340
- [33] MACSOG Documentation Study, Appendix D, p. 96
- [34] Annex F to MACV Command History, 1969, p. 77
- [35] MACSOG Documentation Study, Appendix E, p. 50
- [36] MACV Command History, 1970, Annex B, p. 20
- [37] Nalty 2005, p. 138
- [38] Plaster 2000, pp. 187–191
- [39] Shawcross 1979, pp. 112–127
- [40] Isaacs, Hardy & Brown 1987, p. 89
- [41] Shaw 2005, pp. 36–37, 61, 166
- [42] MACV Command History 1970, Annex B, p. 24–27
- [43] Annex B to MACV Command History, 1970, pp. 230, 236
- [44] Schlemmer 1976
- [45] Nolan 1986
- [46] Plaster, *SOG*, p. 317–324.
- [47] Warner 1996, pp. 198–302, 306–314
- [48] Isaacs, Hardy & Brown 1987, pp. 87–88
- [49] Cowley, p. 337.
- [50] MACV Command History 1971–72, Annex B, p. 11
- [51] MACV Command History 1971–72, Annex B, pp. 216, 300, & 383
- [52] USMACV Strategic Technical Directorate Assistance Team – 158 Command History, 1 May 1972 – March 1973, pp. 15–17
- [53] USMACV Strategic Technical Directorate Assistance Team – 158 Command History, 1 May 1972 – March 1973, pp. 15–19
- [54] USMACV Strategic Technical Directorate Assistance Team – 158 Command History, 1 May 1972 – March 1973, p. 18
- [55] MACV Command History 1970, Annex B, pp. 127–137
- [56] U.S. Senate, 91st Congress, First Session 1970; U.S. Senate, 93rd Congress, First Session 1973

- [57] U.S. Senate, Records of Senate Subcommittee on POW/MIA Affairs. Working Papers of Sedgwick Tourison, last revision, 15 March 1993. Charles E. Schamel Center for Legislative Archives, National Archives and Records Administration, Washington, DC.
- [58] U.S. Senate, Committee on Veteran's Affairs 1979
- [59] Moïse 1996, p. 51
- [60] Shawcross 1979, pp. 63–66

31.15 Sources

Unpublished government documents

- Joint Chiefs of Staff (1970). *Military Assistance Command Studies and Observations Group*, Documentation Study (July 1970).
- US Military Assistance Command, Vietnam, Strategic Technical Directorate Assistance Team 158 (1973). *Command History I May 1972 – March 1973*. Saigon: STDAT-158.
- US Military Assistance Command, Vietnam Studies and Observations Group (1965). *Annex A, Command History 1964*. Saigon: MACVSOG.
- — (1966). *Annex N, Command History 1965*. Saigon: MACVSOG.
- — (1967). *Annex M, Command History 1966*. Saigon: MACVSOG.
- — (1968). *Annex G, Command History 1967*. Saigon: MACVSOG.
- — (1969). *Annex F, Command History 1968*. Saigon: MACVSOG.
- — (1970). *Annex F, Command History 1969*. Saigon: MACVSOG.
- — (1971). *Annex B, Command History 1970*. Saigon: MACVSOG.
- — (1972). *Annex B, Command History 1971–72*. Saigon: MACVSOG.

Published government documents

- Military History Institute of Vietnam; Pribbenow, Merle L. (Translator) (2002). *Victory in Vietnam: The Official History of the People's Army of Vietnam, 1954–1975*. Lawrence, Kansas: University of Kansas Press. ISBN 978-0-7006-1175-1.
- Nalty, Bernard C. (2005). *The War Against Trucks: Aerial Interdiction in Southern Laos, 1968–1972*. Washington DC: Air Force History and Museums Program.
- US House of Representatives (1972). *United States-Vietnam Relations 1945–1967: A Study Prepared for the Department of Defense. Records of the House Committee on Armed Services*. Washington DC: US Government Printing Office.
- U.S. Senate, 91st Congress, First Session (1970). *Hearings before the Committee on United States Security Agreements and Commitments Abroad of the Committee on Foreign Relations, United States Security Agreements and Commitments Abroad, Kingdom of Laos*. Washington, DC: U.S. Government Printing Office.
- U.S. Senate, 93rd Congress, First Session (1973). *Hearings before the Senate Armed Services Committee. Bombing in Cambodia*. Washington, DC: U.S. Government Printing Office.
- U.S. Senate; Committee on Veteran's Affairs (February 1979). *Medal of Honor Recipients, 1863–1978*. Washington, DC: U.S. Government Printing Office.
- Van Staaveren, Jacob (1993). *Interdiction in Southern Laos, 1964–1968*. Washington DC: Center for Air Force History.

Memoirs and autobiographies

- Colby, William (1978). *Honorable Men: My Life in the CIA*. New York: Simon & Schuster. ISBN 0-671-22875-7.
- Plaster, John L. (1974). *Secret Commandos: Behind Enemy Lines with the Elite Warriors of SOG*. New York: Simon and Schuster. ISBN 0684856735. OCLC 54537114.
- Singlaub, John K.; McConnell, Malcolm (1991). *Hazardous Duty: An American Soldier in the Twentieth Century*. New York: Summit Books. ISBN 0671705164. OCLC 23583308.

Secondary sources

- Andrade, Dale (1995). *Trial By Fire: the 1972 Easter offensive, America's last Vietnam battle*. New York: Hippocrene Books. ISBN 0781802865. OCLC 30778306.
- Conboy, Kenneth; Andrade, Dale (2000). *Spies and Commandos: how America lost the secret war in North Vietnam*. Lawrence, Kansas: University of Kansas Press. ISBN 0700611479. OCLC 42061137.
- Conboy, Kenneth; Morrison, James (1995). *Shadow War: The CIA's Secret War in Laos*. Boulder, Colorado: Paladin Press. ISBN 0873648250. OCLC 32753940.
- Dougan, Clark; Weiss, Stephen (1983). *Nineteen Sixty-Eight*. Boston: Boston Publishing Company. ISBN 0939526069. OCLC 9905799.
- Greco, Frank (2004). *Running Recon: A Photo Journey with SOG Special Ops Along the Ho Chi Minh Trail*. Boulder, Colorado: Paladin Press. ISBN 1581604262. OCLC 56793871.
- Isaacs, Arnold R.; Hardy, Gordon; Brown, McAlister (1987). *Pawns of War*. Boston: Boston Publishing Company. ISBN 0939526247. OCLC 17278419.
- Karnow, Stanley (1983). *Vietnam, A History*. New York: Viking Press. ISBN 0140145338. OCLC 236058254.
- Maitland, Terrence; McInerney, Peter (1983). *A Contagion of War*. Boston: Boston Publishing Company. ISBN 0939526050. OCLC 10103256.
- McNamara, Robert S.; VanDeMark, Brian (1995). *In Retrospect*. New York: New York Times Books. ISBN 0812925238. OCLC 31375622.
- Moïse, Edwin (1996). *Tonkin Gulf and the Escalation of the Vietnam War*. Chapel Hill: University of North Carolina Press. ISBN 0-8078-2300-7. OCLC 34477141.
- Nolan, Keith W. (1986). *Into Laos*. Novato, CA: Presidio. ISBN 0891412476. OCLC 13581560.
- Parnar, Joe; Dumont, Robert (2007). *SOG Medic: Stories from Vietnam and Over the Fence*. Boulder, Colorado: Paladin Press. ISBN 9781581606263. OCLC 239277869.
- Plaster, John L. (2000). *SOG: A Photo History of the Secret Wars*. Boulder, Colorado: Paladin Press. ISBN 1-58160-597-8. OCLC 44584774.
- Prados, John (1998). *The Blood Road: The Ho Chi Minh Trail and the Vietnam War*. New York: John Wiley and Sons. ISBN 0471254657. OCLC 59490721.
- Saal, Harve (1990). *SOG – MACV Studies and Observations Group (Behind Enemy Lines) (Four vols. Vol I. Historical Evolution; Vol. II Locations; Vol. III Legends; Vol. IV Appendices.)*. Ann Arbor, Michigan: Edwards Brothers.
- Schlemmer, Benjamin (1976). *The Raid*. Harper & Row. ISBN 0060138025. OCLC 2330976.
- Shaw, John (2005). *The Cambodian Campaign: The 1970 Offensive and America's Vietnam War*. Lawrence, Kansas: University of Kansas Press. ISBN 0700614052. OCLC 59098863.
- Shawcross, William (1979). *Sideshow: Kissinger, Nixon, and the Destruction of Cambodia*. New York: Washington Square Press. ISBN 0671230700. OCLC 4569931.

- Shultz, Richard H. (1999). *The Secret War Against Hanoi: Kennedy's and Johnson's use of spies, saboteurs, and covert warriors in North Vietnam*. New York: Harper Collins. ISBN 0-06-019454-5. OCLC 42061189.
- Tourison, Sedgewick (1995). *Secret Army, Secret War: Washington's Tragic Spy Operation in North Vietnam*. Annapolis Maryland: Naval Institute Press. ISBN 1557508186. OCLC 32469154.
- Veith, George J. (1998). *Code-Name BRIGHTLIGHT*. New York: Dell.
- Warner, Roger (1996). *Shooting at the Moon: The Story of America's Clandestine War in Laos*. South Royalton VT: Steerforth Press. ISBN 1883642361. OCLC 42881425.

31.16 External links

- [MACV SOG](#)
- [Presidential Unit Citation article](#)
- [MACV SOG Homepage](#)
- [MACV-SOG KIA Lists by year \(e.g. 1971\)](#)
- [Viet Nam Bibliography: SOG](#)
- [MACV-SOG "Over the Fence" Uniform Article](#)

Chapter 32

Mirepoix (cuisine)

For other uses, see Mirepoix (disambiguation).

A **mirepoix** (/mɪərˈpwaː/ *meer-**PWAH***; French pronunciation: [mɪʁˈpwa]) is diced vegetable cooked for a long time on



Mirepoix, with some additional greens, on cutting board

a gentle heat without colour or browning, usually with butter or other fat or oil. It is not *sautéed* or otherwise hard cooked, the intention being to sweeten rather than caramelise. Further cooking, often with the addition of tomato purée, creates a darkened brown mixture called *pincage*. Where the flavour base is not pre-cooked the constituent vegetables may be cut to a larger size depending on the overall cooking time for the dish. Usually a mixture of **onions**, **carrots**, and **celery** (either common pascal celery or **celeriac**), the traditional ratio is two parts onions, one part carrots, and one part celery.* [1] Mirepoix is the flavor base for a wide variety of dishes, such as **stocks**, **soups**, **stews**, and **sauces**.

Similar flavor bases include the Italian *soffritto*, the Spanish *sofrito*, from Portuguese-speaking nations *refogado* (braised onions, garlic, and tomato), the German *Suppengrün* (leeks, carrots, and celeriac), the Polish *włoszczyzna* (leeks, carrots, celery root, and parsley root), the U.S. Cajun and Creole **holy trinity** (onions, celery, and bell peppers), and possibly the French *duxelles* (mushrooms and often onion or shallot and herbs, reduced to a paste).

32.1 History

Though the cooking technique is probably older, the term “mirepoix” dates from the 18th century and derives, as do many other appellations in French cuisine, * [2] from the aristocratic employer of the cook credited with establishing and stabilizing it: in this case, * [3] Charles-Pierre-Gaston François de Lévis, duc de Lévis-Mirepoix (1699–1757), French field marshal and ambassador and a member of the noble family of Lévis, lords of Mirepoix in Languedoc since the 11th century. * [4] According to Pierre Larousse (quoted in the *Oxford Companion to Food*), the unfortunate Duke of Mirepoix was “an incompetent and mediocre individual...who owed his vast fortune to the affection Louis XV felt toward his wife and who had but one claim to fame: he gave his name to a sauce made of all kinds of meat and a variety of seasonings”:

The term is not encountered regularly in French culinary texts until the 19th century, so it is difficult to know what a dish *à la mirepoix* was like in 18th-century France. Beauvilliers, * [5] for instance, in 1814, gives a short recipe for a Sauce à la Mirepoix which is a buttery, wine-laced stock garnished with an aromatic mixture of carrots, onions, and a *bouquet garni*. Carême, in the 1830s, gives a similar recipe, calling it simply Mire-poix; and, by the mid-19th century, Gouffé refers to a mirepoix as “a term in use for such a long time that I do not hesitate to use it here”. His mirepoix is listed among essences and, indeed, is a meaty concoction (laced with two bottles of Madeira!), which, like all other essences, was used to enrich many a classic sauce. By the end of the 19th century, the mirepoix had taken on its modern meaning and Joseph Favre in his *Dictionnaire universel de cuisine* (circa 1895, reprinted 1978) uses the term to describe a mixture of ham, carrots, onions, and herbs used as an aromatic condiment when making sauces or braising meat. * [6]

The *matignon* * [6] is very similar to the mirepoix, except that the *matignon* is designed to be brought to the table and eaten with the dish or alone as a side dish.

According to the 1938 *Larousse Gastronomique*, a mirepoix may be prepared “*au gras*” (with meat) or “*au maigre*” (“lean”). * [7] *Mirepoix au maigre* is sometimes called a *brunoise* * [8] (though strictly speaking this term more accurately merely designates the technique of cutting into small dices with a knife). A *mirepoix au gras* contains diced ham or pork belly as an additional ingredient. Similar combinations, both in and out of the French culinary repertoire, may include leeks, parsnips, garlic, tomatoes, shallots, mushrooms, bell peppers, chilies, and ginger, according to the requirements of the regional cuisine or the instructions of the particular chef or recipe. * [9] The analogous *soffritto* (frequently containing parsley) is the basis for many traditional dishes in classic Italian cuisine, and the *sofrito* serves a similar purpose in Spanish cuisines. In Cajun and Creole cuisine, a mirepoix or (jocularly so-called) “holy trinity” is a combination of onions, celery, and bell peppers.

Traditionally, the weight ratio for mirepoix is 2:1:1 of onions, celery, and carrots; * [1] the ratio for bones to mirepoix for stock is 10:1. When making a white stock, or *fond blanc*, parsnips are used instead of carrots to maintain the pale color.

32.2 International versions

32.2.1 German *Suppengrün*

Suppengrün ['zɔpɪŋˌɡʁʏːn] means soup greens in German, and the Dutch equivalent is *soepgroente*. Soup greens usually come in a bundle and consists of a leek, a carrot, and a piece of celeriac. It may also contain parsley, thyme, celery leaves, rutabaga (swede), parsley root, and onions. The mix depends on regional traditions, as well as individual recipes. The vegetables used are cold-climate roots and bulbs with long shelf lives. *Suppengrün* act as herbs and impart hearty, strong flavors to the soup or sauce, providing a foil for other strong tasting ingredients such as dried peas and beans or pot roast. * [10] Large chunks of vegetables are slow cooked to make flavorful soups and stocks, and are discarded when the vegetables have given up most of their flavor. Finely chopped *Suppengrün* are browned in fat and used as a basis for a finished sauce. The vegetables may also be cooked long enough until they fall apart, and may become part of the sauce or pureed to form the sauce.



Chopped chives and onions

32.2.2 Italian *soffritto*

The Italian version of mirepoix is called *soffritto* (not to be confused with the Spanish *sofrito*), a base of finely chopped parsley and onion sautéed in lard, but most modern cooks substitute olive oil or butter. Garlic, celery, or carrot may also be included.*[11]

According to the Italian restaurateur Benedetta Vitali, *soffritto* means “underfried” and describes it as “a preparation of lightly browned minced vegetables, not a dish by itself.” At one time it was called “false ragout”, because *soffritto* was thought to vaguely recall the flavor of meat sauce.*[12]

32.2.3 Polish *włoszczyzna*

Włoszczyzna [vwɔɕ'ʦizna] is the Polish word for soup vegetables or greens. The word literally means “Italian stuff” because Queen Bona Sforza, who was Italian and married Polish King Sigismund I the Old in 1518, introduced this concept to Poland.*[13] A *włoszczyzna* may consist of carrots, parsnips or parsley root, celery root or celeriac, leeks, and savoy or white cabbage leaves, and sometimes celery leaves and flat-leaf parsley. The most typical, packaged combination is celery root, parsley root, carrots, and leeks. *Włoszczyzna* is usually tied up and boiled to form a flavour base for soups and stews.

32.3 References

- [1] The Culinary Institute of America (2011). *The Professional Chef* (9th ed.). Hoboken, New Jersey: John Wiley & Sons. ISBN 978-0-470-42135-2. OCLC 707248142.
- [2] Jean Vitaux, “Peut-on écrire l’ histoire de la gastronomie?” (French)
- [3] *Petit lexique culinaire* (French)
- [4] French Wikipedia: Maison de Lévis.
- [5] See subsection, “Dining Out” , a history of the restaurant, in wikipedia entry for French cuisine.



A typical set of soup greens, known as włoszczyzna, used in Polish cuisine: carrots, parsley root and leaves, leek, and celeriac. Bay leaves and allspice grains are also shown.

- [6] Alan Davidson, *Oxford Companion to Food* (Oxford: Oxford University Press, 1999), p. 509.
- [7] Since the 17th century, recipe books in France had been organized so readers could plan meals in accordance with prescribed days for fasting according to the Roman Catholic liturgical calendar. See Sean Takats, *The Expert Cook in Enlightenment France* (Baltimore, Maryland: Johns Hopkins University Press) p. 110.
- [8] *Larousse Gastronomique*, Montagné, Prosper, and Gottschalk, eds., introduction by A. Escoffier and Philéas Gilbert (Paris: Librerie Larousse, 1938), p. 690.
- [9] The 1938 Larousse (op. cit) recommends the addition of thyme and powdered bay leaf to the *mirepoix au maigre*, for example.

[10]

[11] Hazan, Marcella (2011-07-20). Essentials of Classic Italian Cooking (Kindle Location 168). Knopf Doubleday Publishing Group. Kindle Edition.

[12] Benedetta Vitali, *Soffritto: Tradition and Innovation in Tuscan Cooking* (Berkeley, Toronto: Ten Speed Press, 2001), pp. 7–8.

[13]

32.4 External links

- Mirepoix, entry in *The Food Timeline*

Chapter 33

Mosaic (genetics)

In **genetics**, a **mosaic**, or **mosaicism**, is the presence of two or more populations of **cells** with different **genotypes** in one individual, who has developed from a single fertilized egg. ^[1] Mosaicism has been reported to be present in as high as 70% of **cleavage stage embryos** and 90% of **blastocyst-stage embryos** derived from **in vitro fertilization**. ^[2]

Genetic mosaicism can result from many different mechanisms including chromosome **non-disjunction**, **anaphase lag** and **endoreplication**. ^[2] Anaphase lagging is the most common way by which mosaicism arises in the preimplantation embryo. ^[2] Mosaicism can also result from a **mutation** in one cell during **development** in which the mutation is passed on to only its daughter cells. Therefore, the mutation is only going to be present in a fraction of the adult cells. ^[1]

Genetic mosaics may often be confused with **chimerism**, in which two or more genotypes arise in one individual similarly to mosaicism. However, the two genotypes arise from the fusion of more than one **fertilized zygote** in the early stages of **embryonic development**, rather than from a mutation.

33.1 Types

Different types of mosaicism exist, such as gonadal mosaicism (restricted to the **gametes**) or tissue or somatic mosaicism.

33.1.1 Somatic mosaicism

Somatic mosaicism occurs when the **somatic cells** of the body are of more than one genotype. In the more common mosaics, different genotypes arise from a single fertilized egg cell, due to **mitotic** errors at first or later cleavages.

In rare cases, **intersex** conditions can be caused by mosaicism where some cells in the body have **XX** and others **XY** chromosomes (46, **XX/XY**). ^[1]^[2]

The most common form of mosaicism found through prenatal diagnosis involves **trisomies**. Although most forms of trisomy are due to problems in **meiosis** and affect all cells of the organism, there are cases where the trisomy occurs in only a selection of the cells. This may be caused by a **nondisjunction** event in an early mitosis, resulting in a loss of a chromosome from some trisomic cells. ^[3] Generally this leads to a milder **phenotype** than in non-mosaic patients with the same disorder.

An example of this is one of the milder forms of **Klinefelter syndrome**, called **46/47 XY/XXY mosaic** wherein some of the patient's cells contain **XY** chromosomes, and some contain **XXY** chromosomes. The **46/47** annotation indicates that the **XY** cells have the normal number of 46 total chromosomes, and the **XXY** cells have a total of 47 chromosomes.

Around 30% of **Turner's syndrome** cases demonstrate mosaicism, while complete **monosomy** (45, X) occurs in about 50–60% of cases.

But mosaicism need not necessarily be deleterious. Revertant somatic mosaicism is a rare recombination event in which there is a spontaneous correction of a mutant, **pathogenic allele**. ^[4] In revertant mosaicism, the healthy tissue formed by mitotic recombination can outcompete the original, surrounding mutant cells in tissues like **blood** and **epithelia** that regenerate often. ^[4] In the skin disorder **ichthyosis with confetti**, normal skin spots appear early in life

and increase in number and size over time.*[4]

Other endogenous factors can also lead to mosaicism including mobile elements, DNA polymerase slippage, and unbalanced chromosomal segregation.*[5] Exogenous factors include nicotine and UV radiation.*[5] Somatic mosaics have been created in *Drosophila* using X-ray treatment and the use of irradiation to induce somatic mutation has been a useful technique in the study of genetics.*[6]

True mosaicism should not be mistaken for the phenomenon of X-inactivation, where all cells in an organism have the same genotype, but a different copy of the X chromosome is expressed in different cells. The latter is the case in normal (XX) female mammals, although it is not always visible from the phenotype (like it is in calico cats). However, all multicellular organisms are likely to be somatic mosaics to some extent.*[7]

Somatic mutation leading to mosaicism is prevalent in the beginning and end stages of human life.*[5] Somatic mosaics are common in embryogenesis due to retrotransposition of L1 and Alu transposable elements.*[5] In early development, DNA from undifferentiated cell types may be more susceptible to mobile element invasion due to long, un-methylated regions in the genome.*[5] Further, the accumulation of DNA copy errors and damage over a lifetime lead to greater occurrences of mosaic tissues in aging humans. As our longevity has increased dramatically over the last century, our genome may not have had time to adapt to cumulative effects of mutagenesis.*[5] Thus, cancer research has shown that somatic mutations are increasingly present throughout a lifetime and are responsible for most leukemia, lymphomas, and solid tumors.*[8]

Mitotic recombination

One basic mechanism which can produce mosaic tissue is mitotic recombination or somatic crossover. It was first discovered by Curt Stern in *Drosophila* in 1936. The amount of tissue which is mosaic depends on where in the tree of cell division the exchange takes place. A phenotypic character called “Twin Spot” seen in *Drosophila* is a result of mitotic recombination. However, it also depends on the allelic status of the genes undergoing recombination. Twin spot occurs only if the heterozygous genes are linked in repulsion i.e. trans phase. The recombination needs to occur between the centromere the adjacent gene. This gives an appearance of yellow patches on the wild type background in *Drosophila*. another example of mitotic recombination is the Bloom's syndrome which happens due to the mutation in the *blm* gene. The resulting BLM protein is defective. the defect in RecQ an helicase facilitates the defective unwinding of DNA during replication and is thus associated with the occurrence of this disease.*[9] *[10]

33.1.2 Germline mosaicism

Main article: Germline mosaicism

Germline or gonadal mosaicism is a special form of mosaicism, where some gametes—i.e., sperm or oocytes—carry a mutation, but the rest are normal.*[11] *[12]

The cause is usually a mutation that occurred in an early stem cell that gave rise to all or part of the gonadal tissue.

This can cause only some children to be affected, even for a dominant disease.

33.2 Use in experimental biology

Genetic mosaics can be extraordinarily useful in the study of biological systems, and can be created intentionally in many model organisms in a variety of ways. They often allow for the study of genes that are important for very early events in development, making it otherwise difficult to obtain adult organisms in which later effects would be apparent. Furthermore, they can be used to determine the tissue or cell type in which a given gene is required and to determine whether a gene is cell autonomous. That is, whether or not the gene acts solely within the cell of that genotype, or if it affects neighboring cells which do not themselves contain that genotype, but take on that phenotype due to environmental differentiation.

The earliest examples of this involved transplantation experiments (technically creating chimeras) where cells from a blastula stage embryo from one genetic background are aspirated out and injected into a blastula stage embryo of a different genetic background.

Genetic mosaics are a particularly powerful tool when used in the commonly studied fruit fly, where they are created

through **mitotic recombination**. Mosaics were originally created by irradiating flies **heterozygous** for a particular **allele** with **X-rays**, inducing double-strand DNA breaks which, when repaired, could result in a cell **homozygous** for one of the two alleles. After further rounds of replication, this cell would result in a patch, or “clone” of cells mutant for the allele being studied.

More recently the use of a **transgene** incorporated into the *Drosophila* genome has made the system far more flexible. The **Flip Recombinase** (or **FLP**) is a gene from the commonly studied yeast *Saccharomyces cerevisiae* which recognizes “Flip Recombinase Target” (FRT) sites, which are short sequences of DNA, and induces **recombination** between them. FRT sites have been inserted transgenically near the **centromere** of each chromosome arm of *Drosophila melanogaster*. The FLP gene can then be induced selectively, commonly using either the **heat shock promoter** or the **GAL4/UAS system**. The resulting clones can be identified either negatively or positively.

In negatively marked clones the fly is **transheterozygous** for a gene encoding a visible marker (commonly the green **fluorescent protein** or **GFP**) and an allele of a gene to be studied (both on chromosomes bearing FRT sites). After induction of FLP expression, cells that undergo recombination will have progeny that are homozygous for either the marker or the allele being studied. Therefore, the cells that do not carry the marker (which are dark) can be identified as carrying a mutation.

It is sometimes inconvenient to use negatively marked clones, especially when generating very small patches of cells, where it is more difficult to see a dark spot on a bright background than a bright spot on a dark background. It is possible to create positively marked clones using the so-called **MARCM** (“Mosaic Analysis with a Repressible Cell Marker”, pronounced [mark-em]) system, developed by Liqun Luo, a professor at Stanford University, and his post-doc Tzumin Lee who now leads a group at Janelia Farm Research Campus. This system builds on the **GAL4/UAS** system, which is used to express GFP in specific cells. However a globally expressed **GAL80** gene is used to repress the action of GAL4, preventing the expression of GFP. Instead of using GFP to mark the wild-type chromosome as above, GAL80 serves this purpose, so that when it is removed by **mitotic recombination**, GAL4 is allowed to function, and GFP turns on. This results in the cells of interest being marked brightly in a dark background.*[13]

33.3 History




The phenomenon was discovered by **Curt Stern**. In the 1930s, he demonstrated that **genetic recombination**, normal in **meiosis**, can also take place in **mitosis**.*[14]*[15] When it does, it results in somatic (body) mosaics. These are organisms which contain two or more genetically distinct types of tissue.*[16] The term “somatic mosaicism” was used by C. W. Cotterman in 1956 in his seminal paper on **antigenic variation**.*[5]

33.4 See also

- Chimera (genetics)
- Gynandromorph
- Heterochromia
- Parasitic twin
- Vanishing twin
- X0/XY mosaic

33.5 References

- [1] Marchi, M. De; et al. (2008). “True hermaphroditism with XX/XY sex chromosome mosaicism: Report of a case” . *Clinical Genetics*. **10** (5): 265–72. doi:10.1111/j.1399-0004.1976.tb00047.x. PMID 991437.
- [2] Fitzgerald, P. H.; Donald, R. A.; Kirk, R. L (1979). “A true hermaphrodite dispermic chimera with 46,XX and 46,XY karyotypes” . *Clinical genetics*. **15** (1): 89–96. doi:10.1111/j.1399-0004.1979.tb02032.x. PMID 759058.
- [3] Strachan, Tom; Read, Andrew P. (1999). “Chromosome abnormalities” . *Human Molecular Genetics* (2nd ed.). New York: Wiley–Liss. ISBN 1-85996-202-5. PMID 21089233.

- [4] Jongmans, M. C. J.; et al. (2012). “Revertant somatic mosaicism by mitotic recombination in Dyskeratosis Congenita.” . *American Journal of Human Genetics*. **90** (3): 426–433. doi:10.1016/j.ajhg.2012.01.004. PMC 3309184  PMID 22341970.
- [5] De, S. (2011). “Somatic mosaicism in healthy human tissues” . *Trends in Genetics*. **27** (6): 217–223. doi:10.1016/j.tig.2011.03.002.
- [6] Blair, S. S. “Genetic mosaic techniques for studying Drosophila development” . *Development*. **130** (21): 5065–5072. doi:10.1242/dev.00774.
- [7] Hall, J. G. (1988). “Review and hypotheses: Somatic mosaicism, observations related to clinical genetics” . *American Journal of Human Genetics*. **43** (4): 355–363. PMC 1715487  PMID 3052049.
- [8] Jacobs, K. B.; et al. (2012). “Detectable Clonal Mosaicism and Its Relationship to Aging and Cancer” . *Nature Genetics*. **44** (6): 651–U668. doi:10.1038/ng.2270. PMC 3372921  PMID 22561519.
- [9] King R. C; Stansfield W. D. and Mulligan P. K. 2006. *A Dictionary of Genetics*. 7th ed, Oxford University Press. p282
- [10] <https://www.ncbi.nlm.nih.gov/books/NBK1398/>
- [11] <https://health.google.com/health/ref/Mosaicism>
- [12] Schwab, Angela L.; et al. (2007). “Gonadal mosaicism and familial adenomatous polyposis” . *Familial Cancer*. **7** (2): 173–7. doi:10.1007/s10689-007-9169-1. PMID 18026870.
- [13] Lee, Tzumin; Luo, Liqun (1999). “Mosaic analysis with a repressible cell marker for studies of gene function in neuronal morphogenesis” . *Neuron*. **22** (3): 451–61. doi:10.1016/S0896-6273(00)80701-1. PMID 10197526.
- [14] Stern, C. and K. Sekiguti 1931. Analyse eines Mosaikindividuums bei *Drosophila melanogaster*. *Bio. Zentr.* **51**, 194–199.
- [15] Stern C. 1936. “Somatic crossing-over and segregation in *Drosophila melanogaster*”. *Genetics* **21**, 625–730.
- [16] Stern, Curt 1968. “Genetic mosaics in animals and man” . pp27–129, in Stern, C. *Genetic Mosaics and Other Essays*. Harvard University Press, Cambridge, MA.

33.6 Further reading

- Taylor, T. H.; Gitlin, S. A.; Patrick, J. L.; Crain, J. L.; Wilson, J. M.; Griffin, D. K. (2014). “The origin, mechanisms, incidence and clinical consequences of chromosomal mosaicism in humans” . *Human Reproduction Update*. **20** (4): 571–581. doi:10.1093/humupd/dmu016. ISSN 1355-4786. PMID 24667481.

Chapter 34

Most-wanted Iraqi playing cards



The playing cards

In the 2003 invasion of **Iraq** by a United States-led coalition, the U.S. military developed a set of **playing cards** to help troops identify the **most-wanted** members of President Saddam Hussein's government, mostly high-ranking members of the Iraqi Regional Branch of the Arab Socialist Ba'ath Party or members of the Revolutionary Command Council. The cards were officially named the "**personality identification playing cards**".

34.1 About the cards

Each card contains the wanted person's address and, if available, the job performed by that individual. The highest-ranking cards, starting with the aces and kings, were used for the people at the top of the most-wanted list. The ace of spades is Saddam Hussein, the aces of clubs and hearts are his sons Qusay and Uday respectively, and the ace of diamonds is Saddam's presidential secretary Abid Hamid Mahmud al-Tikriti. This strict correspondence to the order of the most-wanted list was not carried through the entire deck, but some time later in 2003, the list itself was renumbered to conform (almost) to the deck of cards. The card backs feature a green military camouflage pattern.

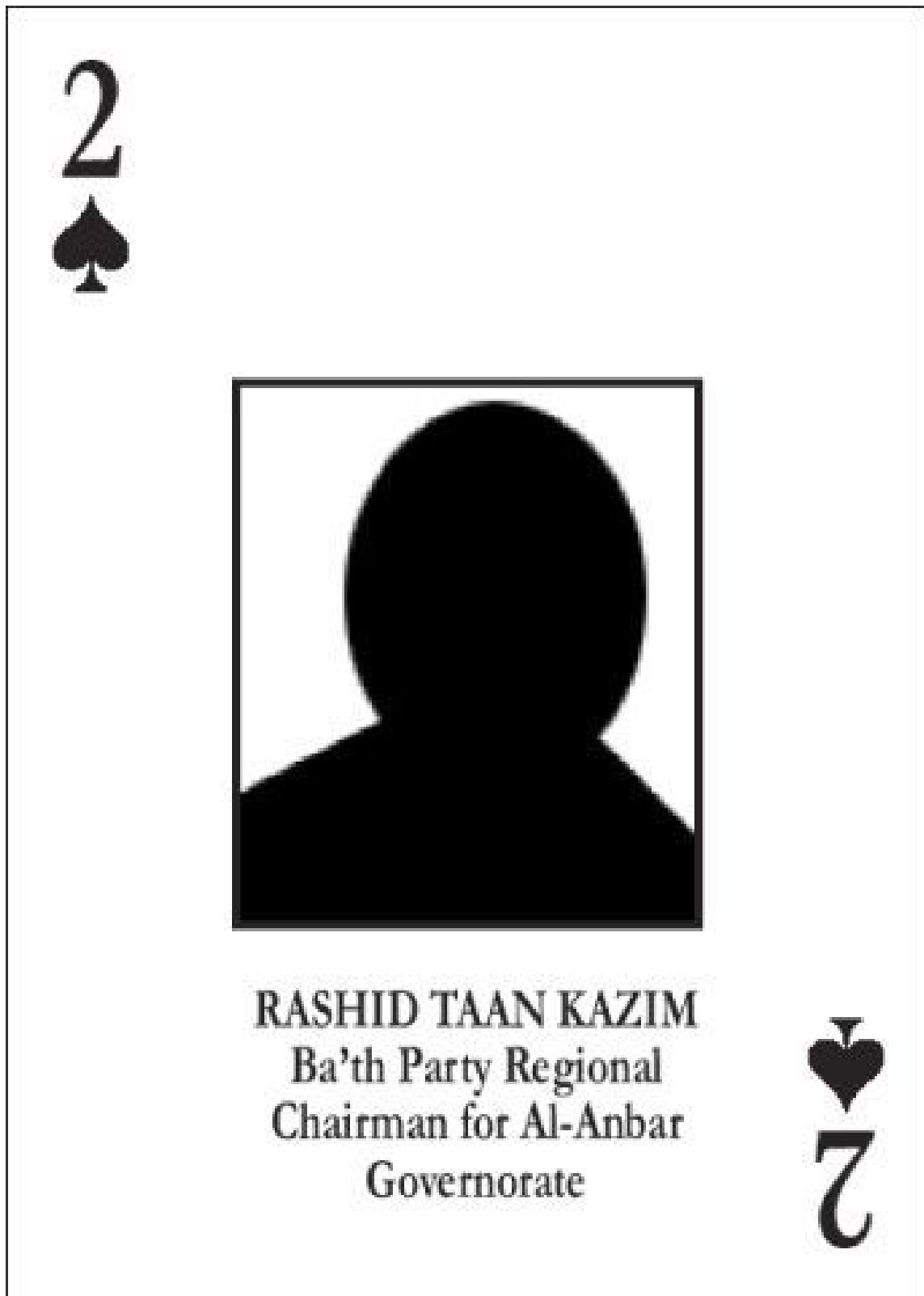
According to US Navy Lieutenant commander Jim Brooks, a spokesman for the Defense Intelligence Agency, such playing cards have been used as far back as the US Civil War and again in World War II—Army Air Corps decks printed with the silhouettes of German and Japanese fighter aircraft fetch hundreds of dollars today—and in the Korean War. Troops often play cards to pass the time, and seeing the names, faces and titles of the wanted Iraqis during their games will help soldiers and Marines in case they run into the wanted individuals in the field, Brooks said.*[1]

The list of “Most Wanted” was the result of a multi-intelligence agency collaboration which included the Defense Intelligence Agency, Central Command, and representatives from all US Service Branch Intelligence entities. The “Most Wanted” names were then assigned to their respective cards by five US Army soldiers, 2LT Hans Mumm, SSG Shawn Mahoney, SGT Andrei Salter, SGT Scott Boehmler, and SPC Joseph Barrios, who were assigned to the Defense Intelligence Agency.*[2] The pictures used on the cards came from a number of intelligence agencies, but most were derived from “open sources”. The deck of cards was first announced publicly in Iraq on 11 April 2003, in a press conference by Army Brig. Gen. Vincent Brooks, deputy director of operations at U.S. Central Command. On that same evening Max Hodges, a Houston-based entrepreneur, found and downloaded a high-resolution artwork file for the deck from a Defense Department web server. Discovering the following day that the file had vanished from the military web server he became the first eBay seller to offer the artwork file, in PDF, which could be used to reproduce the deck.*[3] He quickly contracted Gemaco Playing Card Company to print 1,000 decks for about \$4,000 and started selling both the decks, in advance of receiving them from the printer, on eBay, Amazon.com and his own web site. When some of his early auctions for a \$4 deck of cards quickly rose to over \$120,*[4] it did not take long for other eBayers to jump on the bandwagon and print or order decks of their own to sell. In just a few days hundreds of sellers materialized and the price dropped to just a few dollars per deck.

Texas-based Liberty Playing Card Co. received an order to manufacture the cards for the U.S. Embassy in Kuwait and by claiming to be “the authorized government contractor” quickly became another popular domestic supplier for the commercial market. The U.S. military inadvertently included in the jokers the trademarked Hoyle joker owned by the United States Playing Card Company of Cincinnati, Ohio. Although The U.S. Playing Card company does not object to the government's use of the image, they do object to other companies using the trademarked image. Thus, in some sense, the U.S. military inadvertently granted The U.S. Playing Card Company exclusive rights to manufacture the authentic decks, if the trademarked images on the jokers are considered a requirement for being authentic.

34.1.1 Spades

- Ace ♠: Saddam Hussein, president (#1 on most-wanted list) (Executed 2006).
- King ♠: Ali Hassan al-Majid, also known as Chemical Ali (#5) (Executed 2010).
- Queen ♠: Muhammad Hamza Zubaydi, retired RCC member (#9, but was originally #18) (Died in Custody 2005).
- Jack ♠: Ibrahim Ahmad Abd al-Sattar Muhammad, Iraqi armed forces chief of staff (#13, was #11) (Died in Custody 2010).
- Ten ♠: Hamid Raja Shalah, Air Force commander (#17, was #15) (Captured 2005).
- Nine ♠: Rukan Razuki Abd Al-Ghafar Sulayman Al-Majid, head of tribal affairs office (#21, was #39) (Killed in 2003).*[5]
- Eight ♠: Tariq Aziz, deputy prime minister (#25, was #43) (Surrendered 2003 and sentenced to death, Died in June 2015).
- Seven ♠: Mahmud Dhiyab, minister of interior (#29, was #46) (Surrendered 2003, Released in July 2012).*[6]
- Six ♠: Amir Rashid Muhammad al-Ubaydi, presidential adviser/former oil minister (#33, was #47) (Surrendered 2003, Released in April 2012).
- Five ♠: Watban Ibrahim Hasan, presidential adviser (#37, was #51) (Captured 2003 and sentenced to death. Died of natural causes in custody on August 2015).*[7]
- Four ♠: Muhammad Zimam Abd al-Razzaq, Ba'ath Party branch command chairman (#41, was #23)
- Three ♠: Sa'd Abdul-Majid Al-Faisal, Ba'ath Party branch command chairman (#55, was #36)
- Two ♠: Rashid Taan Kazim, Ba'ath Party regional chairman (#49, was #30).



Rashid Taan Kazim playing card

34.1.2 Clubs

- Ace ♣: Qusay Saddam Husayn, son of Saddam (#2), killed in standoff with the U.S. Army in Mosul, Iraq 2003.

- King ♣: Izzat Ibrahim al-Douri, RCC vice chairman (#6).
- Queen ♣: Kamal Mustafa Abdallah Sultan, secretary of the Republican Guard (#10, was #8).
- Jack ♣: Sayf Al-Din Fulayyih Hasan Taha Al-Rawi, Republican Guard chief of staff (#14, was #12).
- Ten ♣: Latif Nusayyif Jasim, Ba'ath Party military bureau deputy chairman (#18, was #37).
- Nine ♣: Jamal Mustafa Abdallah Sultan, deputy head of tribal affairs (#22, was #40).
- Eight ♣: Walid Hamid Tawfiq, governor of Basra (#26, was #44).
- Seven ♣: Ayad Futayyih Khalifa al-Rawi, Quds forces chief of staff (#30, was #20).
- Six ♣: Husam Muhammad Amin, head of National Monitoring Directorate (#34, was #49) (Released 2005).
- Five ♣: Barzan Ibrahim Hasan, presidential adviser (#38, was #52) (Executed 2007).
- Four ♣: Samir Abd Al-Aziz, Ba'ath Party branch command chairman (#42, was #24). (Captured 2003)
- Three ♣: Sayf al-Din Al-Mashhadani, Ba'ath Party branch command chairman (#46, was #27).
- Two ♣: Uгла Abid Saqr, Ba'ath Party regional chairman (#50, was #31).

34.1.3 Hearts

- Ace ♥: Uday Saddam Husayn, son of Saddam Hussein, killed in standoff with US Army in Mosul, Iraq 2003 (#3).
- King ♥: Hani Abd al-Latif Tilfah, Director—special security organization (#7).
- Queen ♥: Barzan Abd al-Ghafur Sulayman Majid, Special Republican Guard commander (#11, was #9).
- Jack ♥: Rafi Abd Al-Latif Tilfah, director of general security (#15, was #13).
- Ten ♥: Abd Al-Tawab Mullah Huwaysh, deputy prime minister (#19, was #16).
- Nine ♥: Mizban Khadr Hadi, RCC member (#23, was #41).
- Eight ♥: Sultan Hashim Ahmad, minister of defense (#27, was #19) (Captured 2003, Sentenced to Death).
- Seven ♥: Zuhayr Talib Abd Al-Sattar, director of military intelligence (#31, was #21).
- Six ♥: Muhammad Mahdi (#35, was #48).
- Five ♥: Huda Salih Mahdi Ammash, weapons of mass destruction scientist (known as “Mrs. Anthrax”; No. 39, was #53; also the only female on the entire list) (Released 2005).
- Four ♥: Humam Abd Al-Khaliq Abd, minister of higher education and scientific research (#43, was #54).
- Three ♥: Fadil Mahmud Gharib, Ba'ath Party branch command chairman (#47, was #28).
- Two ♥: Ghazi Hammud, Ba'ath Party branch command chairman (#51, was #32).

34.1.4 Diamonds

- Ace ♦: Abid Hamid Mahmud, presidential secretary (#4), executed on 7 June 2012. ^{*}[8]
- King ♦: Aziz Salih, Ba'ath Party branch command chairman (#8, was #17, sentenced to death in 2011).
- Queen ♦: Muzahim Sa'b Hassan al-Tikriti, air defense forces commander (#12, was #10) (Captured 2003, Released in April 2012).
- Jack ♦: Tahir Jalil Habbush, Iraqi intelligence service (#16, was #14).
- Ten ♦: Taha Yasin Ramadan, vice president/RCC member (executed in 2007; #20, was #38).



Rafi Abd Al-Latif Tilfah playing card

- Nine ♦: Taha Muhyi Al-Din Maruf, vice president/RCC member (#24, was #42, died in exile in 2009).
- Eight ♦: Hikmat Mizban Ibrahim, deputy prime minister and finance minister (#28, was No. 45 – Died in Custody 2012).

- Seven ♦: Amir Hamudi Hasan, presidential scientific adviser (#32, was #55).
- Six ♦: Sabawi Ibrahim Hasan, presidential adviser (#36, was #50- Died of cancer in 2013).
- Five ♦: Abd al-Baqi Abd al-Karim Abdallah, Ba'ath Party branch command chairman (#40, was #22 - Captured in 2015).
- Four ♦: Yahya Abdallah, Ba'ath Party branch command chairman (#44, was #25), (Killed in 2003).*[9]
- Three ♦: Muhsin Khadr, Ba'ath Party branch command chairman (#48, was #29).
- Two ♦: Adil Abdallah Mahdi, Ba'ath Party branch command chairman (#52, was #33).

34.1.5 Other

There are also two jokers: one lists Arab titles, the other Iraqi military ranks. There are no cards for most-wanted No. 45 (was #26), Nayif Shindakh Thamir, No. 53 (was #34 – Killed in 2003)*[10] Husayn al-Awadi, or No. 54 (was #35) Khamis Sirhan al-Muhammad, although knight cards could be used for this purpose, but in this case the whole deck would be rearranged. Khamis Sirhan al-Muhammad was captured in January 2004 and held without charge for six years before being released on 30 July 2010. He has since fled to Syria where most of the other 6 uncaptured members of the deck of cards are reported to be hiding.*[11]

The 13 June 2003 edition of the BBC One satirical news quiz, *Have I Got News for You*, featured a set of the playing cards in one round, spoofing guest host Bruce Forsyth's 1980s game show *Play Your Cards Right* (the British version of the American series *Card Sharks*). The two teams played a version of the latter's main game, retitled *Play Your Iraqi Cards Right* (although during the segment it was revealed that the writers' first choice had been *Play Your Kurds Right*), with the same rules (and audience participation). Much of the humour of the round came from the reactions of the two team captains: while Paul Merton was clearly familiar with the game and greatly enjoyed it, his opponent, Ian Hislop, admitted he'd never seen *Play Your Cards Right* and appeared mystified by the game's rules and etiquette (when at one point Merton and the crowd shouted the traditional cry of “lower, lower,” to predict the next card in the hidden sequence, Hislop commented, “I'm not sure this programme could get much lower!”)

34.2 See also

- Archaeology awareness playing cards
- Desert Storm trading cards
- Manhunt (military)
- Mercenaries (video game) - used a similar playing card scheme for enemy leaders.

34.3 Sources

- [1] Burgess, Lisa (17 April 2003). “Buyers beware: The real Iraq 'most wanted' cards are still awaiting distribution” . Stars and Stripes. Retrieved 17 February 2017.
- [2] “The Faces Behind the Faces on the 'Most Wanted' Deck” . Armed Forces Press Service.
- [3] Iraq Most Wanted Identification Playing Cards (PDF version) white rabbit online shop, archived on 27 November 2005 from the original
- [4] Valdes-Dapena, Peter (13 April 2003). “Hot item: 'Most wanted Iraqi' cards” . CNN. Retrieved 13 May 2010.
- [5] "صدام حسين من الزنزانة الامريكية : ماذا يحدث". Dhiqar.net. Retrieved 2013-08-30.
- [6] “Iraq Frees Saddam Hussein's Interior Minister” . Aina.org. Retrieved 2013-08-30.
- [7] Mamoun, Abdelhak. “Watban Ibrahim al-Hassan, half brother of Saddam Hussein, has died - Iraqi News” . *Iraq news, the latest Iraq news by Iraqi News*. Retrieved 2016-02-18.

- [8] "Iraq executes Saddam Hussein's aide Abid Hamid Mahmud" . *BBC News*. 7 June 2012. Retrieved 7 June 2012.
 - [9] DAVID JOHNSTON and JAMES RISEN Published: April 19, 2003 (2003-04-19). "A NATION AT WAR: THE HUNT; New Tape of Hussein Prolongs Debate on His Fate - New York Times" . *Nytimes.com*. Retrieved 2013-08-30.
 - [10] Published: March 25, 2003 (2003-03-25). "A NATION AT WAR: THE IRAQI CAPITAL; HUSSEIN RALLIES IRAQI DEFENDERS TO HOLD CAPITAL - Page 2 - New York Times" . *Nytimes.com*. Retrieved 2013-08-30.
 - [11] Mohammed, Riyadh, "Hussein Backer Set Free In Iraq" , *Los Angeles Times*, 5 August 2010, p. 10.
- Brigadier General Vincent Brooks introduces Iraqi cards at CentComm press conference in Doha, Qatar, 11 April 2003.
 - "Troops Dealt an Old Tool" by Tom Zucco, *St. Petersburg Times*, 12 April 2003.
 - Personality Identification Playing Cards
 - "Card-Carrying Civilians", *Time Magazine*, 12 May 2003, page 25.
 - Brigadier General Vincent Brooks introduced the first set of Iraqi freedom cards, 11 April 2003
 - Card Makers Producing 'Most-Wanted' Decks: Company Warns Others About 'Joker' Image, 23 April 2003, *ClickOnDetroit.com*.
 - Iraqi Most Wanted Scorecard

Chapter 35

Multimarket contact

Multimarket contact occurs when firms meet the same rivals in multiple markets. When firms compete with each other in more than one market their **competitive behavior** may differ from that of single-market rivals. Multimarket competition may result in the reduction of the competitive intensity among rivals, an effect known as mutual forbearance.

Multimarket contact gives a firm the option to respond to actions or attacks by a rival not only in the market being challenged, but also in other markets where they both compete. As a result, multimarket competitors may hesitate to attack in one market for fear of **retaliation** in other markets.

35.1 References

- Gimeno, Javier; Woo, Carolyn (1999). “Multimarket contact, economies of scope, and firm performance” . *Academy of Management Journal*. The Academy of Management Journal, Vol. 42, No. 3. **43** (3): 239–259. doi:10.2307/256917. JSTOR 256917.
- Yu, Tieying; Cannella, Alberta (2007). “Rivalry between multinational enterprises: an event history approach” . *Academy of Management Journal*. **50** (3): 665–686. doi:10.2307/20159878.

Chapter 36

Mushin (mental state)

Mushin (無心; Japanese *mushin*; English translation “*no mind*”) is a mental state into which trained martial artists are said to enter during combat.*[1] They also practice this mental state during everyday activities. The term is shortened from **mushin no shin** (無心の心), a *Zen* expression meaning *the mind without mind* and is also referred to as the state of “no-mindedness”. That is, a mind not fixed or occupied by thought or emotion and thus open to everything.

Mushin is achieved when a person's mind is free from thoughts of anger, fear, or ego during combat or everyday life. There is an absence of discursive thought and judgment, so the person is totally free to act and react towards an opponent without hesitation and without disturbance from such thoughts. At this point, a person relies not on what they *think* should be the next move, but what is their trained natural reaction (or instinct) or what is *felt* intuitively. It is not a state of relaxed, near-sleepfulness, however. The mind could be said to be working at a very high speed, but with no intention, plan or direction.

Some masters believe that *mushin* is the state where a person finally understands the uselessness of techniques and becomes truly free to move. In fact, those people will no longer even consider themselves as “fighters” but merely living beings moving through space.

The legendary Zen master *Takuan Sōhō* said:*[2]

The mind must always be in the state of 'flowing,' for when it stops anywhere that means the flow is interrupted and it is this interruption that is injurious to the well-being of the mind. In the case of the swordsman, it means death. When the swordsman stands against his opponent, he is not to think of the opponent, nor of himself, nor of his enemy's sword movements. He just stands there with his sword which, forgetful of all technique, is ready only to follow the dictates of the subconscious. The man has effaced himself as the wielder of the sword. When he strikes, it is not the man but the sword in the hand of the man's subconscious that strikes.

However, *mushin* is not just a state of mind that can be achieved during combat. Many martial artists train to achieve this state of mind during *kata* so that a flawless execution of moves is accomplished —that they may be achieved during combat or at any other time. Once *mushin* is attained through the practice or study of martial arts (although it can be accomplished through other arts or practices that refine the mind and body), the objective is to then attain this same level of complete awareness in other aspects of the practitioner's life.

36.1 See also

- Flow (psychology)
- Wu wei
- Sahaja
- Samyama
- Fudōshin

- Mokuso
- Shoshin
- Unconscious mind
- Zanshin
- Zen Buddhism

36.2 References

- [1] A Dictionary of the Martial Arts. Louis Frederic (author), Paul H Crompton (editor). 2006. Dover Publications Inc.. ISBN 978-0486444024
- [2] Soho, Takuan. *The Unfettered Mind*. Trans. William Scott Wilson. Tokyo: Kodansha International Ltd., 1986.

Chapter 37

Mutual assured destruction

“Mutually assured destruction” redirects here. For the episode of *The Americans*, see [Mutually Assured Destruction \(The Americans\)](#).

Mutual assured destruction or **mutually assured destruction (MAD)** is a [doctrine](#) of military [strategy](#) and



Aftermath of the atomic bomb explosion over Hiroshima, August 6, 1945

national security policy in which a full-scale use of [nuclear weapons](#) by two or more opposing sides would cause the complete annihilation of both the attacker and the defender (see [pre-emptive nuclear strike](#) and [second strike](#)).*[1] It is based on the theory of [deterrence](#), which holds that the threat of using strong weapons against the enemy prevents the enemy's use of those same weapons. The strategy is a form of [Nash equilibrium](#) in which, once armed, neither side has any incentive to initiate a conflict or to disarm.

37.1 Theory

The MAD doctrine assumes that each side has enough nuclear weaponry to destroy the other side and that either side, if attacked for any reason by the other, would retaliate without fail with equal or greater force. The expected result is an immediate, irreversible escalation of hostilities resulting in both combatants' mutual, total, and assured destruction. The doctrine requires that neither side construct shelters on a massive scale. If one side constructed a similar system of shelters, it would violate the MAD doctrine and destabilize the situation, because it would not have to fear the consequences of a second strike.*[2]*[3] The same principle is invoked against missile defense.

The doctrine further assumes that neither side will dare to launch a first strike because the other side would launch on warning (also called fail-deadly) or with surviving forces (a second strike), resulting in unacceptable losses for both parties. The payoff of the MAD doctrine was and still is expected to be a tense but stable global peace.

The primary application of this doctrine started during the Cold War (1940s to 1991), in which MAD was seen as helping to prevent any direct full-scale conflicts between the United States and the Soviet Union while they engaged in smaller proxy wars around the world. It was also responsible for the arms race, as both nations struggled to keep nuclear parity, or at least retain second-strike capability. Although the Cold War ended in the early 1990s, the MAD doctrine continues to be applied.

Proponents of MAD as part of U.S. and USSR strategic doctrine believed that nuclear war could best be prevented if neither side could expect to survive a full-scale nuclear exchange as a functioning state. Since the credibility of the threat is critical to such assurance, each side had to invest substantial capital in their nuclear arsenals even if they were not intended for use. In addition, neither side could be expected or allowed to adequately defend itself against the other's nuclear missiles. This led both to the hardening and diversification of nuclear delivery systems (such as nuclear missile silos, ballistic missile submarines, and nuclear bombers kept at fail-safe points) and to the Anti-Ballistic Missile Treaty.

This MAD scenario is often referred to as nuclear deterrence. The term “deterrence” was first used in this context after World War II; prior to that time, its use was limited to legal terminology.

37.2 History

37.2.1 Pre-1945

One of the earliest references to the concept comes from the English author Wilkie Collins, writing at the time of the Franco-Prussian War in 1870: “I begin to believe in only one civilizing influence—the discovery one of these days of a destructive agent so terrible that War shall mean annihilation and men's fears will force them to keep the peace.”*[4]

Richard Jordan Gatling patented his namesake rotary gun in 1862 with the partial intention of illustrating the futility of war.*[5]

After his 1867 invention of dynamite, Alfred Nobel stated that “The day when two army corps can annihilate each other in one second, all civilized nations, it is to be hoped, will recoil from war and discharge their troops.”*[6]

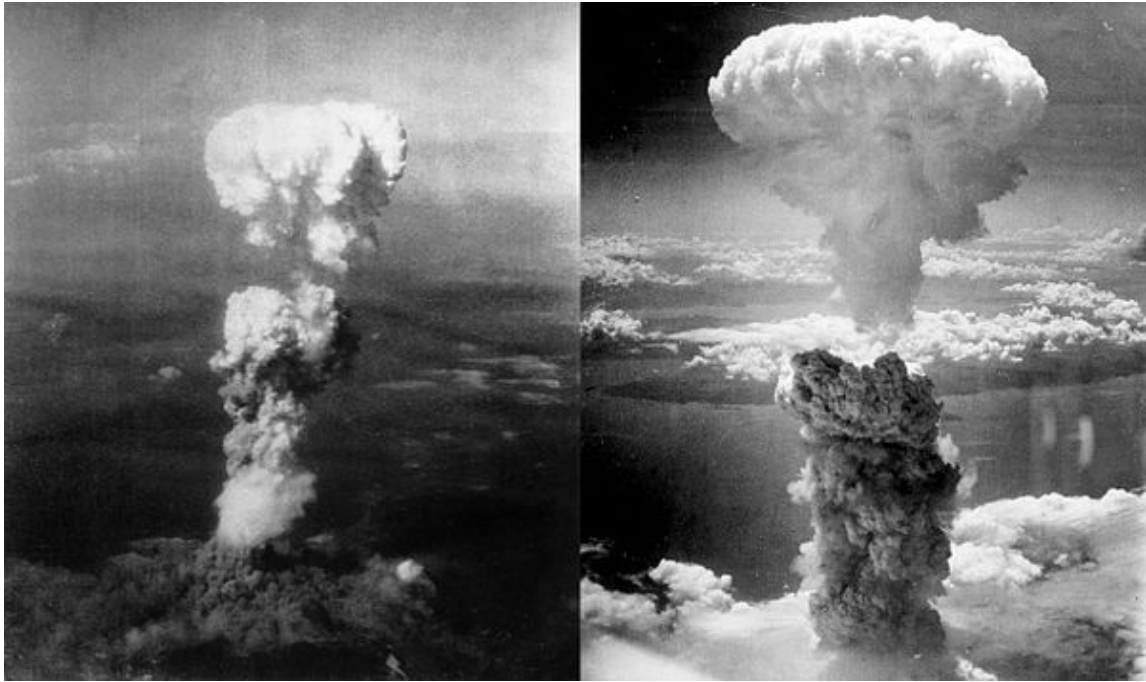
Jan Gotlib Bloch in *The Future of War*, published in 1898, argued that the state could not fight a war “under modern conditions with any prospect of being able to carry that war to a conclusion by defeating its adversary by force of arms on the battlefield. No decisive war is possible that will not entail even upon the victorious Power, the destruction of its resources and the breakup of society. War has therefore become impossible, except at the price of suicide.”*[7]

In 1937, Nikola Tesla published *The Art of Projecting Concentrated Non-dispersive Energy through the Natural Media*,*[8] a treatise concerning charged particle beam weapons.*[9] Tesla described his device as a “superweapon that would put an end to all war.”

In March 1940, the Frisch–Peierls memorandum anticipated deterrence as the principal means of combating an enemy with nuclear weapons.*[10]

37.2.2 Early Cold War

In August 1945, the United States accepted the surrender of Japan after the nuclear attacks on Hiroshima and Nagasaki. Four years later, on August 29, 1949, the Soviet Union detonated its own nuclear device. At the time, both



Atomic bomb explosions over Hiroshima, Japan, 6 August 1945 (left) and over Nagasaki, Japan, 9 August 1945 (right).

sides lacked the means to effectively use nuclear devices against each other. However, with the development of aircraft like the American *Convair B-36* and the Soviet *Tupolev Tu-95*, both sides were gaining a greater ability to deliver nuclear weapons into the interior of the opposing country. The official nuclear policy of the United States became one of "massive retaliation", as coined by President *Dwight D. Eisenhower's* Secretary of State *John Foster Dulles*, which called for massive attack against the Soviet Union if they were to invade Europe, regardless of whether it was a conventional or a nuclear attack.

By the time of the 1962 *Cuban Missile Crisis*, both the United States and the Soviet Union had developed the capability of launching a nuclear-tipped missile from a submerged submarine, which completed the *third leg* of the *nuclear triad* weapons strategy necessary to fully implement the MAD doctrine. Having a three-branched nuclear capability eliminated the possibility that an enemy could destroy all of a nation's nuclear forces in a *first-strike* attack; this, in turn, ensured the credible threat of a devastating *retaliatory strike* against the aggressor, increasing a nation's *nuclear deterrence*.*[11]*[12]*[13]

37.2.3 Two doomsday devices

The strategy of Mutually Assured Destruction and the acronym MAD are due to *John von Neumann* (1903–1957)*[14] and his taste for humorous acronyms, another example being his *MANIAC* computer. He was, among other things, an inventor of *game theory*, a cold war strategist, and chairman of the *Intercontinental ballistic missile* Committee until his death in 1957.

The *RAND* corporation futurist and cold war strategist *Herman Kahn* (1922–1982) believed that although MAD was useful as a metaphor, when pushed to its logical conclusion it became absurd. In his 1960 book *On Thermonuclear War* he advocated a more reasoned approach to nuclear warfare and was misunderstood by some of his critics to be a nuclear war hawk in his writings. (He did however hold a profound belief in the possibility of success in the event of a nuclear war.) He used the concept of the *Doomsday Machine* as an "idealized (almost caricaturized) device"*[15] to illustrate the danger of taking MAD to its extreme. He writes, "I used to be wary of discussing the concept for fear that some colonel would get out a General Operating Requirement or Development Planning Objective for the device" .*[16]

The 1964 film *Dr. Strangelove* parodies some of Kahn's work, and the titular character makes parodic references to Kahn's research, as in this quote from the film (after the United States mistakenly launched a nuclear attack on the USSR): "Under the authority granted me as director of weapons research and development, I commissioned last year a study of this project [of a doomsday machine] by the Bland Corporation. Based on the findings of the report,



John von Neumann

my conclusion was that this idea was not a practical deterrent, for reasons which, at this moment, must be all too obvious.”

Sometime in the 1980s, a second, but real, doomsday device, called **The Dead Hand**, entered the picture in the Soviet Union. Unlike Kahn's device, it was not based on radioactive cobalt, but it was self-activated and could not be stopped.*[17]

37.2.4 Strategic Air Command

See also: [Operation Chrome Dome](#)



Boeing B-47B Stratojet rocket-assisted take off (RATO) on April 15, 1954



B-52D Stratofortress being refueled by a KC-135 Stratotanker, 1965

Beginning in 1955, the United States **Strategic Air Command** (SAC) kept one-third of its bombers on alert, with crews ready to take off within fifteen minutes and fly to designated targets inside the **Soviet Union** and destroy them with nuclear bombs in the event of a Soviet first-strike attack on the United States. In 1961, President John F. Kennedy increased funding for this program and raised the commitment to 50 percent of SAC aircraft.

During periods of increased tension in the early 1960s, SAC kept part of its B-52 fleet airborne at all times, to allow an extremely fast retaliatory strike against the Soviet Union in the event of a surprise attack on the United States. This program continued until 1990 when the bomber wings were placed on quick reaction ground alert and were able to take off within a few minutes. SAC also maintained the National Emergency Airborne Command Post (NEACP, pronounced “kneecap”), also known as “Looking Glass,” which consisted of several EC-135s, one of which was airborne at all times from 1961 through 1990. During the **Cuban missile crisis** the bombers were dispersed to several different airfields, and also were sometimes airborne. For example, some were sent to **Wright Patterson**, which normally didn't have B-52s.

During the height of the tensions between the US and the USSR in the 1960s, two popular films were made dealing with what could go terribly wrong with the policy of keeping nuclear-bomb carrying airplanes at the ready: *Dr. Strangelove* (1964) and *Fail Safe* (1964).

37.2.5 Retaliation capability (second strike)

Main article: [Second strike](#)

The strategy of MAD was fully declared in the early 1960s, primarily by United States Secretary of Defense **Robert McNamara**. In McNamara's formulation there was the very real danger that a nation with nuclear weapons could attempt to eliminate another nation's retaliatory forces with a surprise, devastating first strike and theoretically “win” a nuclear war relatively unharmed. True second-strike capability could be achieved only when a nation had a *guaranteed* ability to fully retaliate after a first-strike attack.

The United States had achieved an early form of second-strike capability by fielding continual patrols of strategic nuclear bombers, with a large number of planes always in the air, on their way to or from **fail-safe points** close to the borders of the Soviet Union. This meant the United States could still retaliate, even after a devastating first-strike attack. The tactic was expensive and problematic because of the high cost of keeping enough planes in the air at all times and the possibility they would be shot down by Soviet **anti-aircraft missiles** before reaching their targets. In addition, as the idea of a **missile gap** existing between the US and the Soviet Union developed, there was increasing priority being given to **ICBMs** over bombers.

It was only with the advent of **ballistic missile submarines**, starting with the *George Washington* class in 1959, that a



Robert McNamara

genuine survivable nuclear force became possible and a retaliatory second strike capability guaranteed.

The deployment of fleets of ballistic missile submarines established a guaranteed second-strike capability because of their stealth and by the number fielded by each Cold War adversary—it was highly unlikely that all of them could be targeted and preemptively destroyed (in contrast to, for example, a missile silo with a fixed location that could be targeted during a first strike). Given their long range, high survivability and ability to carry many medium- and long-range nuclear missiles, submarines were credible and effective means for full-scale retaliation even after a massive first strike.

This deterrence strategy and program has continued into the 21st century, with nuclear submarines carrying Trident II ballistic missiles as one leg of the U.S. strategic nuclear deterrent and as the sole deterrent of the United Kingdom.



The USS George Washington (SSBN-598), the lead ship of the US Navy's first class of Fleet Ballistic Missile Submarines, Nuclear (SSBN)

The USA's other such deterrent comprises the intercontinental ballistic missiles (ICBM)s on alert in the continental United States. Ballistic missile submarines are also operated by the navies of China, France, India and Russia.

The U.S. Department of Defense anticipates a continued need for a sea-based strategic nuclear force.* [18] The first of the current *Ohio*-class SSBNs are expected to be retired by 2029,* [18] meaning that a platform must already be seaworthy by that time. A replacement may cost over \$4 billion per unit compared to the USS *Ohio*'s \$2 billion.* [19] The U.S. Navy is exploring two options. The first is a variant of the *Virginia*-class nuclear attack submarines. The second is a dedicated SSBN, either with a new hull or based on an overhaul of the current *Ohio*-class.

37.2.6 ABMs threaten MAD

Main article: [Anti-ballistic missile](#)

In the 1960s both the Soviet Union (A-35 anti-ballistic missile system) and the United States (LIM-49 Nike Zeus) developed anti-ballistic missile systems. Had such systems been able to effectively defend against a retaliatory second strike, MAD would have been undermined, because a superpower could launch a first strike without fearing the consequences of a retaliatory second strike. See also [Strategic Defense Initiative](#).

37.2.7 MIRVs

Main article: [Multiple independently targetable re-entry vehicle](#)

MIRVs as counter against ABM

The multiple independently targetable re-entry vehicle (MIRV) was another weapons system designed specifically to aid with the MAD nuclear deterrence doctrine. With a MIRV payload, one ICBM could hold many separate warheads. MIRVs were first created by the United States in order to counterbalance Soviet anti-ballistic missile systems around Moscow. Since each defensive missile could be counted on to destroy only one offensive missile, making each offensive missile have, for example, three warheads (as with early MIRV systems) meant that three



A time exposure of seven MIRVs from Peacekeeper missile passing through clouds

times as many defensive missiles were needed for each offensive missile. This made defending against missile attacks more costly and difficult. One of the largest U.S. MIRVed missiles, the LGM-118A Peacekeeper, could hold up to 10 warheads, each with a yield of around 300 kilotons of TNT (1.3 PJ)—all together, an explosive payload equivalent to 230 Hiroshima-type bombs. The multiple warheads made defense untenable with the available technology, leaving the threat of retaliatory attack as the only viable defensive option. MIRVed land-based ICBMs tend to put a premium on striking first. The START II agreement was proposed to ban this type of weapon, but never entered into force.

In the event of a Soviet conventional attack on Western Europe, NATO planned to use tactical nuclear weapons.

The Soviet Union countered this threat by issuing a statement that any use of nuclear weapons (tactical or otherwise) against Soviet forces would be grounds for a full-scale Soviet retaliatory strike (**massive retaliation**). Thus it was generally assumed that any combat in Europe would end with **apocalyptic** conclusions.

Land-based MIRVed ICBMs threaten MAD

MIRVed land-based ICBMs are generally considered suitable for a first strike (inherently **counterforce**) or a counterforce **second strike**, due to:

1. Their high accuracy (**circular error probable**), compared to submarine-launched ballistic missiles which used to be less accurate, and more prone to defects;
2. Their fast response time, compared to bombers which are considered too slow;
3. Their ability to carry multiple MIRV warheads at once, useful for destroying a whole missile field or several cities with one missile.

Unlike a **decapitation strike** or a **countervalue strike**, a **counterforce strike** might result in a potentially more constrained retaliation. Though the Minuteman III of the mid-1960s was MIRVed with three warheads, heavily MIRVed vehicles threatened to upset the balance; these included the **SS-18 Satan** which was deployed in 1976, and was considered to threaten **Minuteman III** silos, which led some **neoconservatives** to conclude a **Soviet** first strike was being prepared for. This led to the development of the aforementioned **Pershing II**, the **Trident I** and **Trident II**, as well as the **MX missile**, and the **B-1 Lancer**.

MIRVed land-based ICBMs are considered destabilizing because they tend to put a premium on striking first. When a missile is MIRVed, it is able to carry many **warheads** (up to eight in existing U.S. missiles, limited by **New START**, though **Trident II** is capable of carrying up to 12* [20]) and deliver them to separate targets. If it is assumed that each side has 100 missiles, with five warheads each, and further that each side has a 95 percent chance of neutralizing the opponent's missiles in their silos by firing two warheads at each silo, then the attacking side can reduce the enemy ICBM force from 100 missiles to about five by firing 40 missiles with 200 warheads, and keeping the rest of 60 missiles in reserve. As such, this type of weapon was intended to be banned under the **START II** agreement; however, the **START II** agreement was never brought into force, and neither Russia nor the United States ratified the agreement.

37.2.8 Late Cold War

The original U.S. MAD doctrine was modified on July 25, 1980, with U.S. President **Jimmy Carter**'s adoption of *countervailing strategy* with **Presidential Directive 59**. According to its architect, Secretary of Defense **Harold Brown**, “countervailing strategy” stressed that the planned response to a Soviet attack was no longer to bomb Soviet population centers and cities primarily, but first to kill the Soviet leadership, then attack military targets, in the hope of a Soviet surrender before total destruction of the Soviet Union (and the United States). This modified version of MAD was seen as a winnable nuclear war, while still maintaining the possibility of assured destruction for at least one party. This policy was further developed by the **Reagan administration** with the announcement of the **Strategic Defense Initiative** (SDI, nicknamed “**Star Wars**”), the goal of which was to develop space-based technology to destroy Soviet missiles before they reached the United States.

SDI was criticized by both the Soviets and many of America's allies (including Prime Minister of the United Kingdom **Margaret Thatcher**) because, were it ever operational and effective, it would have undermined the “assured destruction” required for MAD. If the United States had a guarantee against Soviet nuclear attacks, its critics argued, it would have first-strike capability, which would have been a politically and militarily destabilizing position. Critics further argued that it could trigger a new arms race, this time to develop countermeasures for SDI. Despite its promise of nuclear safety, SDI was described by many of its critics (including Soviet nuclear physicist and later peace activist **Andrei Sakharov**) as being even more dangerous than MAD because of these political implications. Supporters also argued that SDI could trigger a new arms race, forcing the USSR to spend an increasing proportion of GDP on defense—something which has been claimed to have been an indirect cause of the eventual collapse of the Soviet Union.

Proponents of **ballistic missile defense** (BMD) argue that MAD is exceptionally dangerous in that it essentially offers a single course of action in the event of nuclear attack: full retaliatory response. The fact that **nuclear proliferation** has led to an increase in the number of nations in the “**nuclear club**”, including nations of questionable stability (e.g.

Pakistan and North Korea), and that a nuclear nation might be hijacked by a *despot* or other person or persons who might use nuclear weapons without a sane regard for the consequences, presents a strong case for proponents of BMD who seek a policy which both protects against attack, but also does not require an escalation into what might become *global nuclear war*. Russia continues to have a strong public distaste for Western BMD initiatives, presumably because proprietary operative BMD systems could exceed their technical and financial resources and therefore degrade their larger military standing and sense of security in a post-MAD environment. Russian refusal to accept invitations to participate in NATO BMD may be indicative of the lack of an alternative to MAD in current Russian war fighting strategy due to dilapidation of conventional forces after the breakup of the *Soviet Union*.

37.2.9 Post-Cold War

After the fall of the *Soviet Union*, the *Russian Federation* emerged as a sovereign entity encompassing most of the territory of the former USSR. Relations between the United States and this new power have been less tense than they had been with its predecessor. Tensions also decreased between the United States and China.

The administration of U.S. President *George W. Bush* withdrew from the *Anti-Ballistic Missile Treaty* in June 2002, claiming that the limited national missile defense system which they proposed to build was designed only to prevent *nuclear blackmail* by a state with limited nuclear capability and was not planned to alter the nuclear posture between Russia and the United States.

While relations have improved and an intentional nuclear exchange is more unlikely, the decay in Russian nuclear capability in the *post-Cold War era* may have had an effect on the continued viability of the MAD doctrine. A 2006 article by Keir Lieber and Daryl Press stated that the United States could carry out a nuclear first strike on Russia and would “have a good chance of destroying every Russian bomber base, submarine, and ICBM.” This was attributed to reductions in Russian nuclear stockpiles and the increasing inefficiency and age of that which remains. Lieber and Press argued that the MAD era is coming to an end and that the United States is on the cusp of global nuclear primacy. ^[21]

However, in a follow-up article in the same publication, others criticized the analysis, including Peter Flory, the U.S. Assistant Secretary of Defense for International Security Policy, who began by writing “The essay by Keir Lieber and Daryl Press contains so many errors, on a topic of such gravity, that a Department of Defense response is required to correct the record.” ^[22] Regarding reductions in Russian stockpiles, another response stated that “a similarly one-sided examination of [reductions in] U.S. forces would have painted a similarly dire portrait” .

A situation in which the United States might actually be expected to carry out a “successful” attack is perceived as a disadvantage for both countries. The strategic balance between the United States and Russia is becoming less stable, and the objective, technical possibility of a first strike by the United States is increasing. At a time of crisis, this instability could lead to an accidental nuclear war. For example, if Russia feared a U.S. nuclear attack, Moscow might make rash moves (such as putting its forces on alert) that would provoke a U.S. preemptive strike. ^[22]

An outline of current U.S. nuclear strategy toward both Russia and other nations was published as the document “*Essentials of Post-Cold War Deterrence*” in 1995.

37.3 Official policy

Whether MAD was the officially accepted doctrine of the United States military during the Cold War is largely a matter of interpretation. The *United States Air Force*, for example, has retrospectively contended that it never advocated MAD as a sole strategy, and that this form of deterrence was seen as one of numerous options in U.S. nuclear policy. ^[23] Former officers have emphasized that they never felt as limited by the logic of MAD (and were prepared to use nuclear weapons in smaller-scale situations than “assured destruction” allowed), and did not deliberately target civilian cities (though they acknowledge that the result of a “purely military” attack would certainly devastate the cities as well). However, according to a declassified 1959 *Strategic Air Command* study, U.S. nuclear weapons plans specifically targeted the populations of Beijing, Moscow, Leningrad, East Berlin, and Warsaw for systematic destruction. ^[24] MAD was implied in several U.S. policies and used in the political rhetoric of leaders in both the United States and the USSR during many periods of the Cold War.

To continue to deter in an era of strategic nuclear equivalence, it is necessary to have nuclear (as well as conventional) forces such that in considering aggression against our interests any adversary would recognize that no plausible outcome would represent a victory or any plausible definition of victory. To

this end and so as to preserve the possibility of bargaining effectively to terminate the war on acceptable terms that are as favorable as practical, if deterrence fails initially, we must be capable of fighting successfully so that the adversary would not achieve his war aims and would suffer costs that are unacceptable, or in any event greater than his gains, from having initiated an attack.

—President Jimmy Carter in 1980, *Presidential Directive 59, Nuclear Weapons Employment Policy*

The doctrine of MAD was officially at odds with that of the USSR, which had, contrary to MAD, insisted survival was possible.*[25]*[26]*[27] The Soviets believed they could win not only a strategic nuclear war, which they planned to absorb with their extensive *civil defense* planning,*[25]*[28]*[29] but also the conventional war that they predicted would follow after their strategic nuclear arsenal had been depleted.*[30] Official Soviet policy, though, may have had internal critics towards the end of the Cold War, including some in the USSR's own leadership.*[27]

“Nuclear use would be catastrophic.”

—1981, the Soviet General Staff*[27]

37.4 Criticism

The doctrine of nuclear deterrence depends on several challengeable assumptions:

Second-strike capability

Main article: *Second strike*

- A first strike must not be capable of preventing a retaliatory second strike or else mutual destruction is not assured. In this case, a state would have nothing to lose with a first strike, or might try to preempt the development of an opponent's second-strike capability with a first strike (i.e., a *decapitation strike*). To avoid this, countries may design their nuclear forces to make decapitation strike almost impossible, by dispersing launchers over wide areas and using a combination of sea-based, air-based, underground, and mobile land-based launchers.

Perfect detection

- No false positives (errors) in the equipment and/or procedures that must identify a launch by the other side. The implication of this is that an accident could lead to a full nuclear exchange. During the Cold War there were several instances of false positives, as in the case of *Stanislav Petrov*.
- No possibility of camouflaging a launch. The use of *stealth technology* in aircraft such as the B-2 bomber makes this assumption less likely to be fulfilled.
- No means of delivery that does not have the characteristics of a long-range missile delivery, i.e. detectable far ahead of detonation. Again, this assumption is challengeable with, for instance, stealth aircraft, but also with other means, such as smuggling weapons to the target undetected (using devices like a *suitcase nuke*). A close-range missile attack from a submarine would also negate this assumption, as would positioning the weapons close to the intended target.
- Perfect attribution. If there is a launch from the Sino-Russian border, it could be difficult to distinguish which nation is responsible—both *Russia* and *China* have the capability—and, hence, against which nation retaliation should occur.

Perfect rationality

- No rogue commanders will have the ability to corrupt the launch decision process. Such an incident very nearly occurred during the *Cuban Missile Crisis* when an argument broke out aboard a nuclear-armed submarine cut off from radio communication. The second-in-command, *Vasili Arkhipov*, refused to launch despite an order from Captain Savitsky to do so.*[31]

- All leaders with launch capability care about the survival of their subjects (an extremist leader may welcome Armageddon and launch an unprovoked attack). Winston Churchill warned that any strategy will not “cover the case of lunatics or dictators in the mood of Hitler when he found himself in his final dugout.” *[32]

Inability to defend

- No fallout shelter networks of sufficient capacity to protect large segments of the population and/or industry.
- No development of anti-missile technology or deployment of remedial protective gear.

37.5 See also

- Absolute war
- Appeasement
- Balance of terror
- Counterforce
- Moral equivalence
- Nuclear missile defense
- Nuclear holocaust
- Nuclear peace
- Nuclear strategy
- Rational choice theory
- Weapons of Mass Destruction

37.6 References

- [1] Mutual Assured Destruction; Col. Alan J. Parrington, USAF, *Mutually Assured Destruction Revisited*, Strategic Doctrine in Question, Airpower Journal, Winter 1997.
- [2] Freeman Dyson, *Disturbing the Universe*, Chapter 13, *The Ethics of Defense*, Basic Books, 1981.
- [3] *Weapons and Hope*, Freeman Dyson, Harper Collins, 1985
- [4] “Wilkie Collins and Mutually Assured Destruction” . The Wilkie Collins Society. Spring 2009. Retrieved 17 September 2014.
- [5] Paul Wahl and Don Toppel, *The Gatling Gun*, Arco Publishing, 1971.
- [6] “Everything You Need to Know About the First Nobel Prizes” . Retrieved 2016-10-04.
- [7] tr. R. C. Long, Boston, 1914, p XXXI.
- [8] Tesla, Nikola, *THE NEW ART OF PROJECTING CONCENTRATED NON-DISPERSIVE ENERGY THROUGH NATURAL MEDIA*, *System of Particle Acceleration for Use in National Defense*, Circa 16 May 1935.
- [9] Seifer 2001, p. 454
- [10] Brown, Andrew; Arnold, Lorna (2010-09-20). “The Quirks of Nuclear Deterrence” . *International Relations*. **24** (3): 293–312. doi:10.1177/0047117810377278.
- [11] John Barry (2009-12-12). “Do We Still Need a Nuclear 'Triad'?”. *Newsweek*. Retrieved 2010-10-08.
- [12] Office for the Deputy Assistant to the Secretary of Defense for Nuclear Matters. “Nuclear Stockpile” . US Department of Defense. Retrieved 2010-10-08.

- [13] “Toning Up the Nuclear Triad” . *Time*. 1985-09-23. Retrieved 2010-10-08.
- [14] *John von Neumann and Norbert Wiener: From Mathematics to the Technologies of Life and Death*, Steve Joshua Heims, MIT Press, 1982, pages 258–260, <http://www-formal.stanford.edu/jmc/reviews/heims.pdf>
- [15] Kahn, Herman. *On Thermonuclear War*, Transaction Publishers, 2006. p. 145.
- [16] Kahn, Herman. *On Thermonuclear War*, Transaction Publishers, 2006. p. 148.
- [17] Thompson, Nicholas (21 September 2009), *Inside the Apocalyptic Soviet Doomsday Machine*, **17** (10), Wired Magazine.
- [18] “SSBN-X Future Follow-on Submarine” . *Global Security*. Retrieved 2011-09-27.
- [19] Frost, Peter. “Newport News contract awarded” . *Daily Press*. Retrieved 2011-09-27. (Subscription required (help)).
- [20] <http://missilethreat.com/missiles/ugm-133-trident-d-5/>
- [21] Keir A. Lieber and Daryl G. Press “The Rise of U.S. Nuclear Primacy,” *Foreign Affairs*, March/April 2006, pp 42–55.
- [22] Peter C. W. Flory *Nuclear Exchange: Does Washington Really Have (or Want) Nuclear Primacy?* *Foreign Affairs*, September/October 2006
- [23] National Archives and Records Administration, RG 200, Defense Programs and Operations, LeMay's Memo to President and JCS Views, Box 83. Secret.
- [24] “Strategic Air Command Declassifies Nuclear Target List from 1950s” . *nsarchive.gwu.edu*. Retrieved 2016-01-06.
- [25] Richard Pipes (1977). “Why the Soviet Union Thinks It Could Fight and Win a Nuclear War” (PDF). Reed College. Retrieved September 4, 2013.
- [26] Richard Pipes (1977). “Why the Soviet Union thinks it can fight and win a Nuclear War” . Commentary. Retrieved April 21, 2013.
- [27] Burr, William; Savranskaya, Svetlana, eds. (September 11, 2009). “Previously Classified Interviews with Former Soviet Officials Reveal U.S. Strategic Intelligence Failure Over Decades” . Washington, DC. Retrieved April 21, 2013.
- [28] Captain John W. Dorough, Jr. “Soviet Civil Defense U.S.S.R. preparations for industrial-base war survival.” . *Air University Review*, March–April 1977.
- [29] Leon Gouré Reviewed by John C. Campbell (1977). “War Survival in Soviet Strategy: USSR Civil Defense” . *Foreign Affairs magazine*.
- [30] Hoffenaar, Jan; Findlay, Christopher; Wenger, Andreas (series); et al., eds. (November 2007). “Military Planning for European Theatre Conflict During the Cold War: An Oral History Roundtable, Stockholm, 24–25 April 2006” (PDF). *Zürcher Beiträge Zur Sicherheitspolitik*. Center for Security Studies, ETH Zurich (79). Retrieved April 21, 2013.
- [31] Lloyd, Marion (13 October 2002). “Soviets Close to Using A-Bomb in 1962 Crisis, Forum is Told” . *Boston Globe*. pp. A20. Retrieved 7 August 2012.
- [32] Cited in Wolfgang Panofsky, “The Mutual-Hostage Relations between America and Russia,” *Foreign Affairs*, 52/1, (October 1973): p 118.

37.7 External links

- “The Rise of U.S. Nuclear Primacy” from *Foreign Affairs*, March/April 2006
- First Strike and Mutual Deterrence from the Dean Peter Krogh *Foreign Affairs Digital Archives*
- Herman Kahn's *Doomsday Machine*
- Robert McNamara's “Mutual Deterrence” speech from 1967
- Getting MAD: Nuclear Mutual Assured Destruction
- Center for Arms Control and Non-Proliferation
- Council for a Livable World
- Nuclear Files.org Mutual Assured Destruction
- John G. Hines et al. *Soviet Intentions 1965–1985*. BDM, 1995.



A payload launch vehicle carrying a prototype exoatmospheric kill vehicle is launched from Meck Island at the Kwajalein Missile Range on December 3, 2001, for an intercept of a ballistic missile target over the central Pacific Ocean.



Nuclear weapon test Apache (yield 1.85 Mt or 7.7 PJ)

Chapter 38

Neutering

Neutering, from the Latin *neuter* (“of neither sex” * [1]), is the removal of an animal's reproductive organ, either all of it or a considerably large part. “Neutering” is often used incorrectly to refer only to male animals, but the term actually applies to both sexes. The male-specific term is **castration**, while **spaying** is usually reserved for female animals. Colloquially, both terms are often referred to as **fixing**. * [2] In male horses, castrating is referred to as *gelding*. Modern veterinary practice tends to use the term **de-sexing**.

Neutering is the most common method for the sterilization of animals. In the United States, most humane societies, animal shelters, and rescue groups urge pet owners to have their pets neutered to prevent the births of unwanted litters, which contribute to the overpopulation of unwanted animals in the rescue system. Many states require that all adopted cats and dogs be sterilized before going to their new homes.

The practice has been advocated in radio and television commercials and on various shows, most notably the game show *The Price Is Right*, whose host, Bob Barker, would end every episode with the catchphrase “Help control the pet population; have your pets spayed or neutered.” After Barker's retirement, Drew Carey continued to sign off with his own message regarding spaying and neutering.

38.1 Methods of sterilization

38.1.1 Females (spaying)

See also: Pediatric spaying

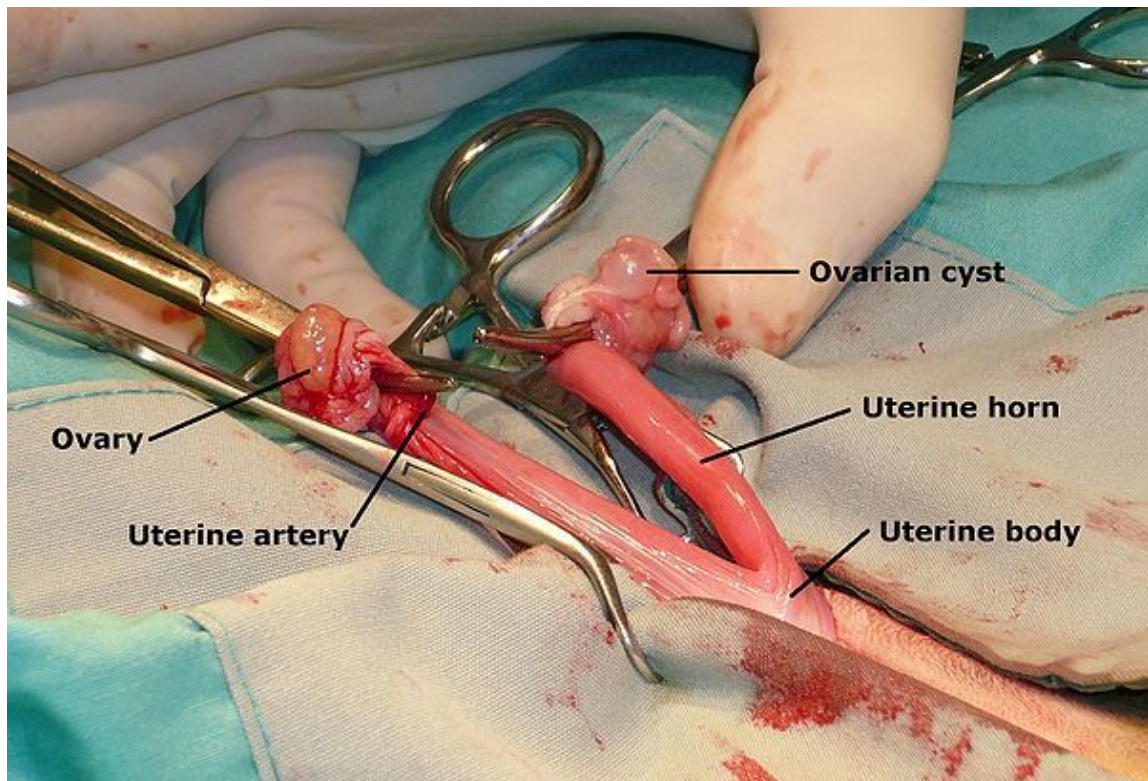
In female animals, spaying involves abdominal surgery to remove the ovaries and uterus (hystero-oophorectomy). Another option is to remove only the ovaries (oophorectomy), which is mainly done in cats and young dogs, and yet another, less commonly performed method is an “Ovary Sparing Spay” * [3] in which the uterus is removed but one (or both) ovaries are left. Traditional spaying (removal of uterus and ovaries) is performed commonly on household pets (such as cats and dogs), as a method of birth control. It is performed less commonly on livestock, as a method of birth control or for other reasons. In mares, these other reasons include behavior modification. * [4]

The surgery can be performed using a traditional open approach or by laparoscopic “keyhole” surgery. Open surgery is more widely available as laparoscopic surgical equipment costs are expensive.

Traditional open surgery is usually performed through a ventral midline incision below the umbilicus. The incision size varies depending upon the surgeon and the size of the animal. The uterine horns are identified and the ovaries are found by following the horns to their ends.

There is a ligament that attaches the ovaries to the body wall, which may need to be broken down so the ovaries can be identified. The ovarian arteries are then ligated with resorbable suture material and then the arteries transected. The uterine body (which is very short in litter-bearing species) and related arteries are also tied off just in front of the cervix (leaving the cervix as a natural barrier). The entire uterus and ovaries are then removed. The abdomen is checked for bleeding and then closed with a three-layer closure. The linea alba and then the subcutaneous layer are closed with resorbable suture material. The skin is then stapled, sutured, or glued closed.

Laparoscopic surgery is performed using a camera and instruments placed through small incisions (ports) in the body wall. The patient is under anaesthesia and lying on the back. The incisions are between 5 and 10 millimetres (0.20



Feline uterus



Incision scar from a spay on a female dog, taken 24 hours after surgery.

and 0.39 in) and the number varies according to the equipment and technique used. The surgeon watches on a screen during the operation. The first port is made just behind the umbilicus and the camera is inserted. The abdomen is inflated with carbon dioxide gas to create a space to operate in. A second port is introduced a few centimeters in front of the navel and a long grasping instrument called a Babcock forceps is inserted. The surgeon finds the ovary with the instrument and uses it to suspend the ovary from a needle placed through the abdominal wall. This lifts the ovary and uterus safely away from other organs. The surgeon then removes the grasping instrument and replaces it with an instrument that cauterizes and cuts tissue. This instrument uses electricity to heat the blood vessels to seal them and to cut them. No sutures are placed inside. The ovary is separated from the uterus and round ligament. The cautery instrument is removed and replaced by the grasping instrument, which is used to pull the ovary out through the small abdominal incision (port). This is repeated on the other side and the small holes are closed with a few sutures.

The benefits of laparoscopic surgery are less pain, faster recovery, and smaller wounds to heal. A study has shown that patients are 70% more active in the first three days post-surgery compared to open surgery. The reason open surgery is more painful is that larger incisions are required, and the ovary needs to be pulled out of the body, which stretches and tears tissue in the abdomen (it is not uncommon for patients to react under anaesthesia by breathing faster at this point).

Spaying in female dogs removes the production of **progesterone**, which is a natural calming hormone and a **serotonin** uplifter. Spaying may therefore escalate any observable aggressive behaviour, either to humans or other dogs.*[5]*[6]*[7]*[8]

The risk of infections, bleeding, ruptures, inflammation and reactions to the drugs given to the animal as part of the procedure are all possibilities that should be considered.

38.1.2 Males (castration or vasectomy)

Main article: **Castration § Animals**

See also: **gelding**

In male animals, castration involves the removal of the **testes**, and is commonly practiced on both household pets (for birth control and behaviour modification) and on livestock (for birth control, as well as to improve commercial value).

38.1.3 Nonsurgical alternatives

Injectable

See also: **Chemical castration**

- Male animals – Injecting a solution of **calcium chloride** dihydrate (20% by weight of CaCl_2 dissolved in **ethanol** – 95% ABV) into the testes of the animal results in nonsurgical castration. Within one month, **necrosis** of the testicular tissue causes sterilization.*[9]*[10]
- Male dogs – **Neutersol** (Zinc gluconate neutralized by arginine). **Cytotoxic**; produces irreversible infertility by chemical disruption of the testicle. It is now produced as **Esterilsol** in Mexico.*[11]
- Male rats – **Adjudin** (analogue of indazole-carboxylic acid), induces reversible germ cell loss from the **seminiferous epithelium** by disrupting cell adhesion function between **nurse cells** and **immature sperm cells**, preventing maturation.
- Male mice – injection of a solution of the JQ1 molecule to bind to a pocket of BRDT necessary for chromatin remodeling, which gives the proteins that regulate how genes act access to the genetic material*[12]
- Male sheep and pigs – Wireless Microvalve.*[13] Using a **piezoelectric polymer** that will deform when exposed to a specific electric field broadcast from a key fob (like a car alarm) the valve will open or close, preventing the passage of sperm, but not **seminal fluid**. Located in a section of the **vas deferens** that occurs just after the **epididymis**, the implantation can be carried out by use of a hypodermic needle.
- Female mammals – Vaccine of antigens (derived from purified **Porcine zona pellucida**) encapsulated in liposomes (cholesterol and lecithin) with an adjuvant, latest US patent **RE37,224** (as of 2006-06-06), CA patent **2137263** (issued 1999-06-15). Product commercially known as **SpayVac**,*[14] a single injection causes a

treated female mammal to produce antibodies that bind to **ZP3** on the surface of her ovum, blocking sperm from fertilizing it for periods from 22 months up to 7 years (depending on the animal^{*}[15]^{*}[16]). This will not prevent the animal from going into heat (ovulating) and other than birth control, none of the above-mentioned advantages or disadvantages apply.

Other

- Male mice – reversible regulation of the KATNAL1 gene in Sertoli Cell Microtubule Dynamics of the testes.^{*}[17]
- Female mammals – orally administered phosphodiesterase 3 inhibitor ORG 9935 daily before and during ovulation, which blocks the resumption of meiosis resulting in ovulation of a non-fertilizable, immature oocyte without rupturing the follicle.^{*}[18]

38.1.4 Surgical alternatives

Vasectomy: The cutting and tying of the **vasa deferentia**. Failure rates are insignificantly small. This procedure is routinely carried out on male **ferrets** and **sheep** to manipulate the estrus cycles of in-contact females. It is uncommon in other animal species.

Tubal Ligation: Snipping and tying of fallopian tubes as a sterilization measure can be performed on female cats and dogs. Risk of unwanted pregnancies is insignificantly small. Only a few veterinarians will perform the procedure.

Like other forms of neutering, vasectomy and tubal ligation eliminate the ability to produce offspring. They differ from neutering in that they leave the animal's levels and patterns of **sex hormone** unchanged. Both sexes will retain their normal reproductive behavior, and other than birth control, none of the advantages and disadvantages listed above apply. This method is favored by some people who seek minimal infringement on the natural state of companion animals to achieve the desired reduction of unwanted births of cats and dogs.

Penile translocation is sometimes performed in cattle to produce a "teaser bull", who retains his full libido, but is incapable of intromission. This is done to identify estrous cows without the risk of transmitting **venereal diseases**.^{*}[19]

38.2 Early-age neutering

Early-age neutering, also known as **pediatric spaying** or prepubertal gonadectomy, is the removal of the ovaries or testes before the onset of **puberty**. It is used mainly in animal sheltering and rescue where puppies and kittens can be neutered before being adopted out, eliminating non-compliance with sterilization agreement, which is typically above 40%.^{*}[20] The American Veterinary Medical Association, American Animal Hospital Association and the Canadian Veterinary Medical Association support the procedure for population control, provided that the veterinarian uses his/her best knowledge when making the decision about the age at neutering.^{*}[21]^{*}[22]^{*}[23]

While the age-unrelated risks and benefits cited above also apply to early-age neutering, various studies have indicated that the procedure is safe and not associated with increased mortality or serious health and behavioral problems when compared to conventional age neutering.^{*}[24]^{*}[25]^{*}[26]^{*}[27]^{*}[28] Anesthesia recovery in young animals is usually more rapid and there are fewer complications.^{*}[28]^{*}[29] One study found that in female dogs there is an increasing risk of urinary incontinence the earlier the procedure is carried out; the study recommended that female dogs be spayed no earlier than 3 to 4 months of age.^{*}[25] A later study comparing female dogs spayed between 4 and 6 months and after 6 months showed no increased risk.^{*}[30]

One study showed the incidence of hip dysplasia increased to 6.7% for dogs neutered before 5.5 months compared to 4.7% for dogs neutered after 5.5 months, although the cases associated with early age neutering seems to be of a less severe form. There was no association between age of neutering and arthritis or long-bone fractures.^{*}[25] Another study showed no correlation between age of neutering and musculoskeletal problems.^{*}[27] A study of large breed dogs with **cranial cruciate ligament** rupture associated early-age neutering with the development of an excessive tibial plateau angle.^{*}[31]

Of particular note are two recent studies from Lynette Hart's lab at UC Davis. The first study from 2013, published in a well-known interdisciplinary peer-reviewed journal^{*}[32] demonstrated "no cases of CCL (cruciate ligament tear) diagnosed in intact males or females, but in early-neutered males and females the occurrences were 5 percent and 8 percent, respectively. Almost 10 percent of early-neutered males were diagnosed with LSA (lymphosarcoma),

3 times more than intact males. The percentage of HSA (hemangiosarcoma) cases in late-neutered females (about 8 percent) was 4 times more than intact and early-neutered females. There were no cases of MCT (mast cell tumor) in intact females, but the occurrence was nearly 6 percent in late-neutered females”

The second study from 2014 * [33] highlighted significant difference in closely related breeds (retrievers), suggesting that inter-breed variability is quite high and that sweeping legal measures and surgical mandates are not the best solutions to canine welfare and health. Specifically the study states: “In Labrador Retrievers, where about 5 percent of gonadally intact males and females had one or more joint disorders, neutering at 6 months doubled the incidence of one or more joint disorders in both sexes. In male and female Golden Retrievers, with the same 5 percent rate of joint disorders in intact dogs, neutering at 6 months increased the incidence of a joint disorder to 4–5 times that of intact dogs. The incidence of one or more cancers in female Labrador Retrievers increased slightly above the 3 percent level of intact females with neutering. In contrast, in female Golden Retrievers, with the same 3 percent rate of one or more cancers in intact females, neutering at all periods through 8 years of age increased the rate of at least one of the cancers by 3–4 times. In male Golden and Labrador Retrievers neutering had relatively minor effects in increasing the occurrence of cancers.”

In terms of behavior in dogs, separation anxiety, aggression, escape behavior and inappropriate elimination are reduced while noise phobia and sexual behavior was increased. In males with aggression issues, earlier neutering may increase barking.* [25] In cats, asthma, gingivitis, and hyperactivity were decreased, while shyness was increased. In male cats, occurrence of abscesses, aggression toward veterinarians, sexual behaviors, and urine spraying was decreased, while hiding was increased.* [24]

38.3 Health and behavioral effects

See also: [Castration § Medical consequences](#)

38.3.1 Advantages

Besides being a birth control method, and being convenient to many owners, castrating/spaying has the following health benefits:

- Sexually dimorphic behaviors such as mounting, urine spraying and some forms of male aggression are reduced due to the decrease in hormone levels brought about by neutering. This is especially significant in male cats due to the extreme undesirability of these male cat sexual behaviors for many pet owners.* [20]
- Early spaying significantly reduces the risk of development of mammary tumours in female dogs. The incidence of mammary tumours in un-spayed female dogs is 71% (of which approximately 50% will be malignant and 50% will be benign), but if a dog is spayed before its first heat cycle, the risk of developing a mammary tumour is reduced to 0.35% — a 99.5% reduction. The positive effects of spaying on reduction of later mammary tumours decreases with each heat the dog has (backing up the contention that the greatest benefit to reduce future mammary tumour development is to spay before the first heat), and there is no added benefit to spaying to reduce recurrence of a mammary tumour once it has been diagnosed.* [34]
- Neutering increases life expectancy in cats: one study found castrated male cats live twice as long as intact males, while spayed female cats live 62% longer than intact females. Non-neutered cats in the USA are three times more likely to require treatment for an animal bite. Having a cat neutered confers health benefits, because castrated males cannot develop testicular cancer, spayed females cannot develop uterine, cervical or ovarian cancer, and both have a reduced risk of mammary cancer.
- Without the ability to reproduce, a female necessarily has zero risk of pregnancy complications, such as spotting and false pregnancy, the latter of which can occur in more than 50% of unsplayed female dogs.* [35]
- Pyometra, uterine cancer, ovarian cancer, and testicular cancer are prevented, as the susceptible organs are removed, though stump pyometra may still occur in spayed females.
- Pyometra (or a pus filled womb) ('Pyo' = pus; 'metra' = uterus or womb) is a life-threatening condition that requires emergency veterinary treatment. The risk of a non-spayed bitch developing pyometra by age 10 is 25% across all breeds, but can be as high as 54% in some breeds.* [36] The treatment of choice for a closed-pyometra

(where the cervix is closed and the pus cannot drain) is admission to hospital, commencement on intravenous fluids and appropriate antibiotics and, once stable enough for the anaesthetic and surgery, emergency removal of the infected pus-filled uterus. Medical management can be attempted if the animal's condition allows (for example in the case of an 'open' pyometra where the pus drains per-vaginum from the uterus via the open cervix) or dictates (where the animal is too old or otherwise unwell to withstand surgery), if the owner wishes to keep the dog entire to breed or if the owner is unable to afford the veterinary fees associated with surgery. Emergency removal of the infected uterus carries a much higher degree of risk of death than a routine 'spay' operation. The risk of death from in dogs undergoing surgical treatment for pyometra is up to 17%.^[37] Thus the risk of death in entire female dogs from a pyometra, even if given correct veterinary attention can be up to 9% by 10 years of age (17% of 54%). This risk is reduced to virtually zero if spayed.

38.3.2 Disadvantages

General

- As with any surgical procedure, immediate complications of neutering include the usual **anesthetic** and **surgical** complications, such as bleeding, infection, and death. These risks are relatively low in routine neutering; however, they may be increased for some animals due to other pre-existing health factors. In one study the risk of anesthetic-related death (not limited to neutering procedures) was estimated at 0.05% for healthy dogs and 0.11% for healthy cats. The risks for sick animals were 1.33% for dogs and 1.40% for cats.^[38]
- Spaying and castrating cats and dogs may increase the risk of **obesity** if nutritional intake is not reduced to reflect the lower metabolic requirements of neutered animals.^[39] In cats, a decrease in sex hormone levels seems to be associated with an increase in food intake.^[40] In dogs, the effects of neutering as a risk factor for obesity vary between breeds.^[41]
- Neutered dogs of both sexes are at a twofold excess risk to develop **osteosarcoma** (bone cancer) as compared to intact dogs. The risk of osteosarcoma increases with increasing breed size and especially height.^[42]^[43]^[44]
- Studies of cardiac tumors in dogs showed that there was a 5 times greater risk of **hemangiosarcoma** (cancer of blood vessel lining), one of the three most common cancers in dogs, in spayed females than intact females and a 2.4 times greater risk of hemangiosarcoma in castrated dogs as compared to intact males.^[45]^[46]
- Spaying and castrating is associated with an increase in urinary tract cancers in dogs, however the risk is still less than 1%.^[47]
- Neutered dogs of both sexes have a 27% to 38% increased risk of adverse reactions to vaccinations. However, the incidence of adverse reactions for neutered and intact dogs combined is only 0.32%.^[48]
- Neutered dogs have also been known to develop hormone-responsive **alopecia** (hair loss).^[49]
- A 2004 study found that neutered dogs had a higher incidence of cranial cruciate ligament (CCL) rupture, a form of anterior cruciate ligament (ACL) injury.^[50]
- A study of **golden retrievers** found that castrated males were 3 times more likely than intact males to be diagnosed with **lymphoma** and 2 times more likely to have **hip dysplasia**.^[51]

Specific to males

- About 2% of castrated **male dogs** eventually develop **prostate cancer**, compared to less than 0.6% of intact males.^[52]^[53] The evidence is most conclusive for **Bouvier**s.^[47]
- In a study of 29 intact male dogs and 47 castrated males aged 11–14, the neutered males were significantly more likely to progress from one geriatric cognitive impairment condition (out of the four conditions – disorientation in the house or outdoors, changes in social interactions with human family members, loss of house training, and changes in the sleep-wake cycle) to two or more conditions. Testosterone in intact males is thought to slow the progression of cognitive impairment, at least in dogs that already have mild impairment.^[54]
- As compared to intact males, castrated cats are at an increased risk for certain problems associated with **feline lower urinary tract disease**, including the presence of **stones** or a plug in the **urethra** and urethral blockage.^[55]
- Neutering also has been associated with an increased likelihood of urethral sphincter incontinence in male dogs.^[56]

Specific to females

Further information: *Canine reproduction § Altered Females*

- There is some weak evidence that spaying can increase the risk of *urinary incontinence* in dogs, especially when done before the age of three months. Up till 12 months of age, the risk decreases as the age at spaying increases. ^[57]
- Spayed female dogs are at an increased risk of *hypothyroidism*. ^[58]

38.3.3 Current research

Various studies of the effects neutering has overall on male and female dog aggression have been unable to arrive at a consensus. A possible reason for this according to two studies is changes to *other factors* have more of an effect than neutering. ^[59]^[60] One study reported results of aggression towards familiar and strange people and other dogs reduced between 10 and 60 percent of cases, ^[61] while other studies reported increases in possessive aggression ^[62] and aggression towards familiar and strange people, ^[63] and more studies reported there was no significant difference in aggression risk between neutered and non-neutered males. ^[60]^[64] For females with existing aggression, many studies reported increases in aggressive behavior ^[5]^[6]^[7]^[8] and some found increased separation anxiety behavior. ^[63]^[65] A report from the American Kennel Club Canine Health Foundation reported significantly more behavioral problems in castrated dogs. The most commonly observed behavioral problem in spayed females was fearful behavior and the most common problem in males was aggression. ^[66] Early age gonadectomy is associated with an increased incidence of noise phobias and undesirable sexual behaviors. ^[67]

38.4 Terminology for neutered animals

A specialized vocabulary is used in *animal husbandry* and *animal fancy* for neutered (castrated) animals:

barrow Pig castrated before maturity. ^[68]

bullock Male castrated *draft animal*. ^[69]

capon Male castrated *chicken*. ^[68]

gelding Male castrated horse, ^[70] or donkey.

gib Male castrated *cat*, ^[71] or *ferret*. ^[68]

havier Male castrated *deer*. ^[72]

lapin Male castrated *rabbit*. ^[68]

ox Male castrated *draft animal*. ^[69]

spay Female neutered *cat*. ^[71]

poulard Female neutered *chicken*.

sprite Female neutered *ferret*. ^[68]

steer Male *cattle* castrated before maturity. ^[68]

stag Male *cattle* or pig castrated after maturity. ^[68]

wether Male castrated *goat* or *sheep*. ^[68]

38.5 Religious views

38.5.1 Islam

While there are differing views in Islam with regard to neutering animals, ^{*}[73] some Islamic associations have stated that when done to maintain the health and welfare of both the animals and the community, neutering is allowed on the basis of 'maslaha' (general good) ^{*}[74] or “choos[ing] the lesser of two evils” . ^{*}[75]

38.5.2 Judaism

Orthodox Judaism forbids the castration of both humans and non-human animals by Jews, ^{*}[76] except in lifesaving situations. ^{*}[77] In 2007, the Sephardic Chief Rabbi of Israel Rabbi Shlomo Amar issued a ruling stating that it is permissible to have companion animals neutered on the basis of the Jewish mandate to prevent cruelty to animals. ^{*}[78]

38.6 See also

- AB 1634 – A California bill proposing mandatory neuter laws.
- Animal population control
- Animal shelter
- Forced sterilization
- Hysterectomy
- Oophorectomy
- Overpopulation in companion animals
- Spay Day USA
- Wildlife contraceptive

38.7 References

- [1] “Latin Word Lookup” . *www.archives.nd.edu*.
- [2] “Fix” at Merriam-Webster.com
- [3] “Ovary-Sparing Spay - Parsemus Foundation” .
- [4] Hooper R. N.; Taylor T. S.; Varner D. D.; Blanchard T. L. (October 1993). “Effects of bilateral ovariectomy via colpotomy in mares: 23 cases (1984–1990)”. *J. Am. Vet. Med. Assoc.* **203** (7): 1043–6. PMID 8226251.
- [5] Polsky R. H. (1996). “Recognizing dominance aggression in dogs” . *Vet. Med.* **91**: 196–201.
- [6] Blackshaw, J.K. (1991). “An overview of types of aggressive behavior in dogs and methods of treatment” . *Appl. Anim. Behav. Sci.* **30** (3–4): 351–361. doi:10.1016/0168-1591(91)90140-S.
- [7] Wright J. C. (1991). “Canine aggression toward people. Bite scenarios and prevention” . *Vet. Clin. North Am. Small Anim. Pract.* **21** (2): 299–314. doi:10.1016/s0195-5616(91)50034-6. PMID 2053252.
- [8] Crowell-Davis S. L. (1991). “Identifying and correcting human-directed dominance aggression of dogs” . *Vet. Med.* **86**: 990–998.
- [9] Leoci, R.; Aiudi, G.; Silvestre, F.; Lacalandra, G. M. (September 2012). “Chemical sterilization with calcium chloride: a dose dependent study in the dog” and “Dog chemical castration by intratesticular injection of a calcium chloride in an alcohol solution” . 1st International Conference on Dog Population Management.
- [10] Koger, L. M. (November 1977). “Calcium Chloride, Practical Necrotizing Agent” . *Journal of the American Association of Bovine Practitioners (USA)*. **12**: 118–119.

- [11] “Neutersol and Esterisol” . *acc-d.org*. Alliance for Contraception in Cats and Dogs. Archived from the original on 31 December 2008. Retrieved 2008-11-28.
- [12] Matzuk, Martin M.; McKeown, Michael R.; Filippakopoulos, Panagis; Li, Qinglei; Ma, Lang; Agno, Julio E.; Lemieux, Madeleine E.; Picaud, Sarah; Yu, Richard N.; Qi, Jun; Knapp, Stefan; Bradner, James E. (2012-08-17). “Small-Molecule Inhibition of BRDT for Male Contraception” . *Cell*. **150** (4): 673–684. doi:10.1016/j.cell.2012.06.045. PMC 3420011 . PMID 22901802.
- [13] Jones, Inke; Ricciardi, Lucas; Hall, Leonard; Hansen, Hedley; Varadan, Vijay; Bertram, Chris; Maddocks, Simon; Enderling, Stefan; Saint, David; Al-Sarawi, Said; Abbott, Derek (2008-01-17). “Wireless RF communication in biomedical applications” (pdf). *Smart Materials and Structures*. IOP Publishing Ltd. **17**: 8–9. doi:10.1088/0964-1726/17/1/015050. Retrieved 2008-06-25.
- [14] SpayVac. Retrieved on early 2003.
- [15] Killian, Gary; Diehl, Nancy K.; Miller, Lowell; Rhyan, Jack; Thain, David (2007). “Long-term Efficacy of Three Contraceptive Approaches for Population Control of Wild Horses” . *Cattlemen's Update*: 48–63.
- [16] DeNicola, Anthony; Miller, Lowell A.; Gionfriddo, James P.; Fagerstone, Kathleen A. (2007-03-16). “Status of Present Day Infertility Technology” . Northeast Association of Fish and Wildlife Agencies. Archived from the original on 29 August 2007. Retrieved 2007-03-16.
- [17] Smith, Lee B.; Milne, L.; Nelson, N.; Eddie, S.; Brown, P.; Atanassova, N.; O’ Bryan, M. K.; O’ Donnell, L.; Rhodes, D.; Wells, S.; Napper, D.; Nolan, P.; Lalanne, Z.; Cheeseman, M.; Peters, J. (May 2012). “KATNAL1 Regulation of Sertoli Cell Microtubule Dynamics is Essential for Spermiogenesis and Male Fertility” . *PLoS Genetics*. **8**: e1002697. doi:10.1371/journal.pgen.1002697. PMC 3359976 . PMID 22654668.
- [18] Jensen, Jeffrey T.; Zelinski, Mary B.; Stanley, Jessica E.; Fanton, John W.; Stouffer, Richard L. (April 2008). “The phosphodiesterase 3 inhibitor ORG 9935 inhibits oocyte maturation in the naturally selected dominant follicle in Rhesus macaques” . *Contraception*. **77** (4): 303–7. doi:10.1016/j.contraception.2008.01.003. PMC 2505347 . PMID 18342656.
- [19] “Penectomized Teaser Bull” . The Drost Project. Retrieved 2011-08-24.
- [20] Kustritz, Margaret V. Root (2007). “Determining the Optimal age for Gonadectomy of Dogs and Cats” . *Journal of the American Veterinary Medical Association*. **231** (11): 1665–75. doi:10.2460/javma.231.11.1665. PMID 18052800.
- [21] “Early-Age (Prepubertal) Spay/Neuter of Dogs and Cats” .
- [22] Early Neutering of Companion Animals Position Statement American Animal Hospital Association
- [23] Dog and Cat Spay/Castration at CanadianVeterinarians.net
- [24] Spain, C. Victor; Scarlett, Janet M.; Houpt, Katherine A. (1 February 2004). “Long-term risks and benefits of early-age gonadectomy in cats” . *Journal of the American Veterinary Medical Association*. **224** (3): 372–379. doi:10.2460/javma.2004.224.372 – via avmajournals.avma.org (Atypen).
- [25] “Long-term risks and benefits of early-age gonadectomy in dogs” (PDF).
- [26] Howe, L. M.; Slater, M. R.; Boothe, H. W.; Hobson, H. P.; Fossum, T. W.; Spann, A. C.; Wilkie, W. S. (2000). “Long-term outcome of gonadectomy performed at an early age or traditional age in cats” . *Journal of the American Veterinary Medical Association*. **217** (11): 1661–5. doi:10.2460/javma.2000.217.1661. PMID 11110455.
- [27] Howe, Lisa M.; Slater, Margaret R.; Boothe, Harry W.; Hobson, H. Phil; Holcom, Jennifer L.; Spann, Angela C. (2001). “Long-term outcome of gonadectomy performed at an early age or traditional age in dogs” . *Journal of the American Veterinary Medical Association*. **218** (2): 217–21. doi:10.2460/javma.2001.218.217. PMID 11195826.
- [28] Howe (1997). “Short-term results and complications of prepubertal gonadectomy in cats and dogs” . *Journal of the American Veterinary Medical Association*. **211** (1): 57–62. PMID 9215412.
- [29] Kustritz, M. (2002). “Early spay-neuter: Clinical considerations” . *Clinical Techniques in Small Animal Practice*. **17** (3): 124–8. doi:10.1053/svms.2002.34328. PMID 12476815.
- [30] De Bleser, B.; Brodbelt, D. C.; Gregory, N. G.; Martinez, T. A. (2009). “The association between acquired urinary sphincter mechanism incompetence in bitches and early spaying: A case-control study” . *The Veterinary Journal*. **187** (1): 42–47. doi:10.1016/j.tvjl.2009.11.004. PMID 20004121.

- [31] Duerr; Duncan, C. G.; Savicky, R. S.; Park, R. D.; Egger, E. L.; Palmer, R. H. (2007). "Risk factors for excessive tibial plateau angle in large-breed dogs with cranial cruciate ligament disease" . *Journal of the American Veterinary Medical Association*. **231** (11): 1688–91. doi:10.2460/javma.231.11.1688. PMID 18052804.
- [32] <http://www.plosone.org/article/fetchObject.action?uri=info%3Adoi%2F10.1371%2Fjournal.pone.0055937&representation=PDF>
- [33] <http://www.plosone.org/article/fetchObject.action?uri=info%3Adoi%2F10.1371%2Fjournal.pone.0102241&representation=PDF>
- [34] Poulton, Gerry. "Mammary Tumours in Dogs" (PDF). Irish Veterinary Journal.
- [35] Gobello, C.; et al. (23 August 2001). "Canine Pseudopregnancy: A Review" (PDF). *IVIS.org*. International Veterinary Information Service. Retrieved 13 April 2010.
- [36] "Breed Risk of Pyometra in Insured Dogs in Sweden". *Journal of Veterinary Internal Medicine*. **15**: 530–538. doi:10.1111/j.1939-1676.2001.tb01587.x.
- [37] "Results and complications of surgical treatment of pyometra: a review of 80 cases" . *Journal of the American Animal Hospital Association*.
- [38] Brodbelt; Blissitt, K. J.; Hammond, R. A.; Neath, P. J.; Young, L. E.; Pfeiffer, D. U.; Wood, J. L. (2008). "The risk of death: the confidential enquiry into perioperative small animal fatalities" . *Veterinary Anaesthesia and Analgesia*. **35** (5): 365–73. doi:10.1111/j.1467-2995.2008.00397.x. PMID 18466167.
- [39] Colliard L.; Paragon B. M.; Lemuet B.; Bénet J. J.; Blanchard G. (February 2009). "Prevalence and risk factors of obesity in an urban population of healthy cats" . *J. Feline Med. Surg.* **11** (2): 135–40. doi:10.1016/j.jfms.2008.07.002. PMID 18774325.
- [40] Cave N. J.; Backus R. C.; Marks S. L.; Klasing K. C. (October 2007). "Oestradiol, but not genistein, inhibits the rise in food intake following gonadectomy in cats, but genistein is associated with an increase in lean body mass" . *J Anim Physiol Anim Nutr (Berl)*. **91** (9–10): 400–10. doi:10.1111/j.1439-0396.2006.00667.x. PMID 17845247.
- [41] McGreevy P. D.; Thomson P. C.; Pride C.; Fawcett A.; Grassi T.; Jones B. (May 2005). "Prevalence of obesity in dogs examined by Australian veterinary practices and the risk factors involved" . *Vet. Rec.* **156** (22): 695–702. doi:10.1136/vr.156.22.695. PMID 15923551.
- [42] Priester; McKay, F. W. (1980). "The Occurrence of Tumors in Domestic Animals" . *National Cancer Institute monograph* (54): 1–210. PMID 7254313.
- [43] Ru, G.; Terracini, B.; Glickman, L. (1998). "Host related risk factors for canine osteosarcoma" . *The Veterinary Journal*. **156** (1): 31–9. doi:10.1016/S1090-0233(98)80059-2. PMID 9691849.
- [44] Cooley, D. M.; Beranek, B. C.; et al. (1 November 2002). "Endogenous gonadal hormone exposure and bone sarcoma risk" . *Cancer Epidemiol Biomarkers Prev*. **11** (11): 1434–40. PMID 12433723.
- [45] Prymak C.; McKee L. J.; Goldschmidt M. H.; Glickman L. T. (1988). "Epidemiologic, clinical, pathologic, and prognostic characteristics of splenic hemangiosarcoma and splenic hematoma in dogs: 217 cases (1985)". *J Am Vet Med Assoc*. **193** (6): 706–712. PMID 3192450.
- [46] Ware, Wendy A.; Hopper, David L. (1999). "Cardiac Tumors in Dogs: 1982–1995" . *Journal of Veterinary Internal Medicine*. **13** (2): 95–103. doi:10.1892/0891-6640(1999)013<0095:CTID>2.3.CO;2. PMID 10225598.
- [47] Sanborn, L. J. (14 May 2007). "Long-Term Health Risks and Benefits Associated with Spay / Neuter in Dogs" (PDF). Retrieved 13 April 2010.
- [48] Moore G. E.; Guptill L. F.; Ward M. P.; Glickman N. W.; Faunt K. F.; Lewis H. B.; Glickman L.T. (2005). "Adverse events diagnosed within three days of vaccine administration in dogs" . *J Am Vet Med Assoc*. **227** (7): 1102–1108. doi:10.2460/javma.2005.227.1102. PMID 16220670.
- [49] Ettinger, Stephen J.; Feldman, Edward C. (1995). *Textbook of Veterinary Internal Medicine* (4th ed.). W. B. Saunders Company. ISBN 0-7216-6795-3.
- [50] Slauterbeck, J. R.; Pankratz, K.; Xu, K. T.; Bozeman, S. C.; Hardy, D. M. (Dec 2004). "Canine Ovariohysterectomy and Orchiectomy Increases the Prevalence of ACL Injury" . *Clinical Orthopaedics and Related Research*. **429**: 301–5. doi:10.1097/01.blo.0000146469.08655.e2.
- [51] Torres de la Riva, Gretel. "Neutering Dogs: Effects on Joint Disorders and Cancers in Golden Retrievers" . *PLOS ONE*. **8**: e55937. doi:10.1371/journal.pone.0055937.

- [52] Teske, E.; Naan, E. C.; Van Dijk, E. M.; Van Garderen, E.; Schalken, J. A. (2002). "Canine prostate carcinoma: epidemiological evidence of an increased risk in castrated dogs" . *Molecular and Cellular Endocrinology*. **197** (1–2): 251–5. doi:10.1016/S0303-7207(02)00261-7. PMID 12431819.
- [53] Sorenmo, K. U.; Goldschmidt, M.; Shofer, F.; Goldkamp, C.; Ferracone, J. (2003). "Immunohistochemical characterization of canine prostatic carcinoma and correlation with castration status and castration time" . *Veterinary and Comparative Oncology*. **1** (1): 48–56. doi:10.1046/j.1476-5829.2003.00007.x. PMID 19379330.
- [54] Hart (2001). "Effect of gonadectomy on subsequent development of age-related cognitive impairment in dogs" . *Journal of the American Veterinary Medical Association*. **219** (1): 51–6. doi:10.2460/javma.2001.219.51. PMID 11439769.
- [55] Lekcharoensuk; Osborne, C. A.; Lulich, J. P. (2001). "Epidemiologic study of risk factors for lower urinary tract diseases in cats" . *Journal of the American Veterinary Medical Association*. **218** (9): 1429–35. doi:10.2460/javma.2001.218.1429. PMID 11345305.
- [56] Aaron, A.; Eggleton, K.; Power, C.; Holt, P. E. (1996). "Urethral sphincter mechanism incompetence in male dogs: a retrospective analysis of 54 cases" . *Vet Rec*. **139**: 542–6. doi:10.1136/vr.139.22.542.
- [57] Beauvais, W.; Cardwell, J. M.; Brodbelt, D. C. (2012). "The effect of neutering on the risk of urinary incontinence in bitches - a systematic review" . *Journal of Small Animal Practice*. **53** (4): 198–204. doi:10.1111/j.1748-5827.2011.01176.x. PMID 22353203.
- [58] Panciera D. L. (1994). "Hypothyroidism in dogs: 66 cases (1987–1992)". *J Amer Vet Med Assoc*. **204** (5): 761–767.
- [59] Kobelt A. J.; Hemsworth P. H.; Barnett J. L.; Coleman G. J. (2003). "A survey of dog ownership in suburban Australia: conditions and behaviour problems" . *Appl. Anim. Behav. Sci.* **82** (2): 137–148. doi:10.1016/S0168-1591(03)00062-5.
- [60] Casey R. A.; Loftus B.; Bolster C.; Richards G. J.; Blackwell E. J. (March 2014). "Human directed aggression in domestic dogs (*Canis familiaris*): Occurrence in different contexts and risk factors" . *Appl. Anim. Behav. Sci.* **152**: 52–63. doi:10.1016/j.applanim.2013.12.003.
- [61] **The Effects of Spaying and Neutering on Canine Behavior** James O' Heare, Association of Animal Behavior Professionals
- [62] Guy N. C.; Luescher U. A.; Dohoo S. E.; Spangler E.; Miller J. B; Dohoo I. R.; Bate L. A. (2001). "A case series of biting dogs: characteristics of the dogs, their behaviour, and their victims" . *Appl. Anim. Behav. Sci.* **74**: 15–57. doi:10.1016/S0168-1591(01)00155-1.
- [63] Takeuchi Y.; Ogata N.; Houpt J. A.; Scarlett J. M. (2001). "Differences in background and outcome of three behavior problems of dogs" . *Appl. Anim. Behav. Sci.* **70** (4): 297–308. doi:10.1016/S0168-1591(00)00156-8. PMID 11179553.
- [64] Neilson J.; Eckstein R.; Hart B. (1997). "Effects on castration on problem behaviors in male dogs with reference to age and duration of behavior" . *JAVMA*. **211** (2): 180–182. PMID 9227747.
- [65] Podberscek A. L.; Serpell J. A. (1996). "The English Cocker Spaniel: preliminary findings on aggressive behaviour" . *Appl. Anim. Behav. Sci.* **47**: 75–89. doi:10.1016/0168-1591(95)01012-2.
- [66] Meuten D. J. *Tumors in Domestic Animals*. 4th Edn. Iowa State Press, Blackwell Publishing Company, Ames, Iowa, p. 575
- [67] Spain C. V.; Scarlett J. M.; Houpt K. A. (2004). "Long-term risks and benefits of early-age gonadectomy in dogs" . *JAVMA*. **224** (3): 380–387. doi:10.2460/javma.2004.224.380. PMID 14765797.
- [68] Amundson Romich, J (2013). "Chapter 5: What's in a name" . *An Illustrated Guide to Veterinary Medical Terminology* (4th ed.). Cengage Learning. pp. 115–126. ISBN 9781133709459.
- [69] Campbell, Joseph K. (1990). *Dibble sticks, donkeys, and diesels : machines in crop production*. Manila, Philippines: International Rice Research Institute. ISBN 97897111041854.
- [70] Hasheider, P; Johnson, S (2014). *The Complete Illustrated Guide to Farming*. MBI Publishing Company. p. 85. ISBN 9781627881371.
- [71] Vanhorn, B; Clark, R (2012). *Veterinary Assisting Fundamentals & Applications*. Cengage Learning. p. 123. ISBN 9781133417040.
- [72] Peek, Hedley; Aflalo, Frederick George, eds. (1897). *The Encyclopaedia of Sport, Volume 1*. London: Lawrence and Bullen. p. 573.
- [73] - "موقع الإسلام سؤال وجواب - عربي" . *www.islamqa.com*.
- [74] "What some religions say about sterilisation."

[75] <http://www.sPCA.org.my/neuter.htm#5> Spaying/Neutering Information

[76] “What does Jewish law say about neutering male pets?”.

[77] Feinstein, Moshe. *Igrot Moshe*.

[78] “CHAI - Why Spay/Neuter is Crucial” . www.chai.org.il.

38.8 External links

- Cat's neutering (video)
- DVM Article on health effects of spay/neuter: Long-Term Health Risks and Benefits Associated with Spay / Neuter in Dogs
- Determining the optimal age for gonadectomy of dogs and cats (pdf)
- Canine Spay Photos and Description
- Educational campaign about spaying/neutering pets at 4 months of age



Surgical incision site of a female cat

Chapter 39

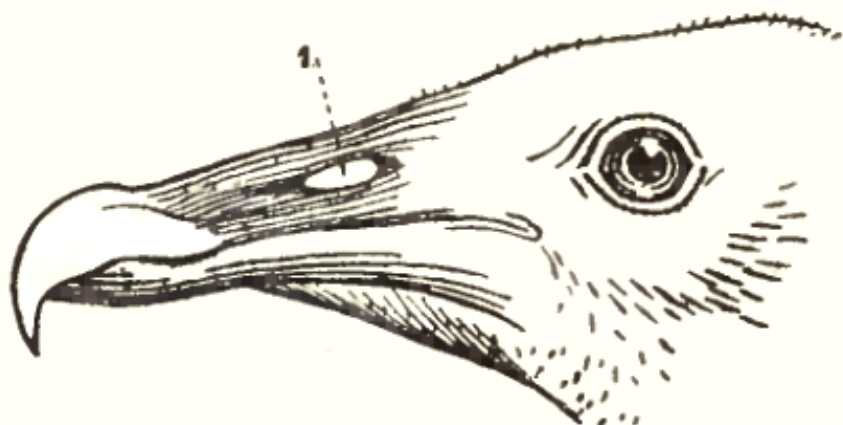
New World vulture

The **New World vulture** or **condor** family **Cathartidae** contains seven **species** in five **genera**, all but one of which are **monotypic**. It includes five **vultures** and two **condors** found in warm and temperate areas of the **Americas**. The “New World” vultures were widespread in both the Old World and **North America** during the **Neogene**.

New World vultures do not form a **monophyletic clade** with the superficially similar family of **Old World vultures**, with the similarities between the two groups being due to **convergent evolution**. Many now consider them to be in their own order **Cathartiformes**, closely related to, but distinct from, Old World vultures and allies (**Accipitriformes**).*[1]

Vultures are scavenging **birds**, feeding mostly from **carcasses** of dead animals without apparent ill effects. Bacteria in the food source, pathogenic to other vertebrates, dominate the vulture's **gut flora**, and vultures benefit from the bacterial breakdown of carrion tissue. New World vultures have a good sense of smell, whereas Old World vultures find carcasses exclusively by sight. A particular characteristic of many vultures is a **bald head**, devoid of **feathers**.

39.1 Taxonomy and systematics



**Head of the Black Turkey-Vulture (*Catharistes urubu*)
to show pervious nostrils.**

A pervious nostril is typical of the family

The New World vultures comprise seven species in five genera. The genera are *Coragyps*, *Cathartes*, *Gymnogyps*, *Sarcoramphus*, and *Vultur*. Of these, only *Cathartes* is not **monotypic**.*[2] The family's scientific name, Cathartidae,

comes from *cathartes*, Greek for “purifier” .*[3] Although New World vultures have many resemblances to Old World vultures they are not very closely related. Rather, they resemble Old World vultures because of convergent evolution.*[4]

New World vultures were traditionally placed in a family of their own in the Falconiformes.*[5] However, in the late 20th century some ornithologists argued that they are more closely related to storks on the basis of karyotype,*[6] morphological,*[7] and behavioral*[8] data. Thus some authorities placed them in the Ciconiiformes with storks and herons; Sibley and Monroe (1990) even considered them a subfamily of the storks. This was criticized,*[9]*[10] and an early DNA sequence study*[11] was based on erroneous data and subsequently retracted.*[12]*[13]*[14] There was then an attempt to raise the New World vultures to the rank of an independent order, Cathartiformes not closely associated with either the birds of prey or the storks and herons.*[15]

However, recent multi-locus DNA studies on the evolutionary relationships between bird groups*[1]*[16] indicate that New World vultures are related to the other birds of prey, excluding the Falconidae which are distantly related to other raptors, and are not close to storks. In this analysis, the New World vultures should be part of a new order Accipitriformes instead,*[16] or perhaps as part of an order (Cathartiformes) closely related to, but distinct from, other birds of prey (besides falcons).*[1] New World vultures are a sister group to Accipitriformes*[1] when the latter is viewed as a group consisting of Accipitridae, the osprey and secretarybird.*[17] Both groups are basal members of the recently recognized clade Afroaves.*[1]

39.1.1 Extinct species and fossils

The fossil history of the Cathartidae is complex, and many taxa that may possibly have been New World vultures have at some stage been treated as early representatives of the family.*[20] There is no unequivocal European record from the Neogene.

It is clear that the Cathartidae had a much higher diversity in the Plio-Pleistocene, rivalling the current diversity of Old World vultures and their relatives in shapes, sizes, and ecological niches. Extinct taxa are:

- *Diatropornis* (“European vulture”) Late Eocene/Early Oligocene –? Middle Oligocene of France*[21]
- *Phasmagyps* Chadronian of Colorado.*[21]*[22]
- Cathartidae gen. et sp. indet. (Late Oligocene of Mongolia)*[21]
- *Brasilogyps* Late Oligocene – Early Miocene of Brazil*[21]
- *Hadrogyps* ("American dwarf vulture") Middle Miocene of SW North America*[21]
- Cathartidae gen. et sp. indet. Late Miocene/Early Pliocene of Lee Creek Mine, USA*[23]
- *Pliogyps* ("Miocene vulture") Late Miocene – Late Pliocene of S North America*[21]
- *Perugyps* ("Peruvian vulture") Pisco Late Miocene/Early Pliocene of SC Peru*[23]
- *Dryornis* ("Argentinean vulture") Early–Late? Pliocene of Argentina; may belong to modern genus *Vultur**[21]
- Cathartidae gen. et sp. indet. (Middle Pliocene of Argentina)*[23]
- *Aizenogyps* ("South American vulture") Late Pliocene of SE North America*[21]
- *Breagyps* ("long-legged vulture") Late Pleistocene of SW North America*[21]
- *Geronogyps* Late Pleistocene of Argentina and Peru*[21]
- *Gymnogyps varonai* late Quaternary of Cuba*[24]
- *Wingegyps* ("Amazonian vulture") Late Pleistocene of Brazil*[25]
- Cathartidae gen. et sp. indet. (Cuba)*[26]



Fossil of the extinct Breagyps clarki

39.2 Description

New World vultures are generally large, ranging in length from the lesser yellow-headed vulture at 56–61 centimeters (22–24 inches) up to the California and Andean condors, both of which can reach 120 centimeters (48 inches) in length and weigh 12 or more kilograms (26 or more pounds). Plumage is predominantly black or brown, and is sometimes marked with white. All species have featherless heads and necks.*[27] In some, this skin is brightly colored, and in the king vulture it is developed into colorful wattles and outgrowths.

All New World vultures have long, broad wings and a stiff tail, suitable for soaring.*[28] They are the best adapted to soaring of all land birds.*[29] The feet are clawed but weak and not adapted to grasping.*[30] The front toes are long with small webs at their bases.*[31] No New World vulture possesses a syrinx,*[32] the vocal organ of birds. Therefore the voice is limited to infrequent grunts and hisses.*[33]



The featherless head of the American black vulture, Coragyps atratus brasiliensis, reduces bacterial growth from eating carrion.

The beak is slightly hooked and is relatively weak compared with those of other birds of prey.*[30] This is because it is adapted to tear the weak flesh of partially rotted carrion, rather than fresh meat.*[29] The nostrils are oval and are set in a soft cere.*[34] The nasal passage is not divided by a septum (it is “perforate”), so that when looking from the side, one can see through the beak.*[35] The eyes are prominent, and, unlike those of eagles, hawks, and falcons, they are not shaded by a brow bone.*[34] Members of *Coragyps* and *Cathartes* have a single incomplete row of eyelashes on the upper lid and two rows on the lower lid, while *Gymnogyps*, *Vultur*, and *Sarcoramphus* lack eyelashes altogether.*[36]

New World vultures have the unusual habit of urohidrosis, or defecating on their legs to cool them evaporatively. As this behavior is also present in storks, it is one of the arguments for a close relationship between the two groups.*[5]

39.3 Distribution and habitat

New World vultures are restricted to the western hemisphere. They can be found from southern Canada to South America.*[37] Most species are mainly resident, but the turkey vulture populations breeding in Canada and the northern US migrate south in the northern winter.*[38] New World vultures inhabit a large variety of habitats and ecosystems, ranging from deserts to tropical rainforests and at heights of sea level to mountain ranges,*[37] using their highly adapted sense of smell to locate carrion. These species of birds are also occasionally seen in human settlements, perhaps emerging to feed upon the food sources provided from roadkills.

39.4 Behaviour and ecology



American black vultures on a horse carcass

39.4.1 Feeding

All living species of New World vultures and condors are **scavengers**. Their diet is overwhelmingly composed of **carrion**, and they are commonly seen in carcasses. Other additions to the diet include fruit (especially rotten fruit) and garbage. An unusual characteristic of the species in genus *Cathartes* is a highly developed sense of smell, which they use to find carrion. They locate carrion by detecting the scent of **ethyl mercaptan**, a gas produced by the bodies of decaying animals. The **olfactory lobe** of the **brains** in these species, which is responsible for processing smells, is particularly large compared to that of other animals.*[39] Other species, such as the American black vulture and the king vulture, have weak senses of smell and find food only by sight, sometimes by following *Cathartes* vultures and other scavengers.*[32] The head and neck of New World vultures are featherless as an adaptation for hygiene; this lack of feathers prevents **bacteria** from the **carrion** it eats from ruining its feathers and exposes the skin to the sterilizing effects of the sun.*[40]

39.4.2 Tolerance to bacterial toxins in decaying meat

Vultures possess a very acidic digestive system and their gut is dominated by two species of anaerobic bacteria that help them withstand **toxins** they ingest when feeding on decaying prey.*[41] In a 2014 study of 50 (turkey and black) vultures, researchers analyzed the microbial community or **microbiome** of the facial skin and the large intestine.*[42] The facial bacterial flora and the gut flora overlapped somewhat, but in general, the facial flora was much more **diverse** than the gut flora, which is in contrast to other vertebrates, where the gut flora is more diverse. Two **anaerobic** faecal bacteria groups that are pathogenic in other vertebrates stood out: **Clostridia** and **Fusobacteria**. They were especially common in the gut with Clostridia **DNA sequence** counts between 26% and 85% relative to total sequence counts, and Fusobacteria between 0.2% and 54% in black vultures and 2% to 69% of all counts in turkey vultures. Unexpectedly, both anaerobic bacteria were also found on the air exposed facial skin samples, Clostridia at 7%–40% and Fusobacteria up to 23%. It is assumed that vultures acquire them when they insert their heads into the body cavities of rotten meat. The regularly ingested Clostridia and Fusobacteria outcompete other bacterial groups in the gut and become predominant. Genes that encode tissue-degrading enzymes and toxins that are associated with *Clostridium perfringens* have been found in the vulture gut **metagenome**. This supports the hypothesis that vultures do benefit from the bacterial breakdown of carrion, while at the same time tolerating the bacterial toxins.*[42]

39.4.3 Breeding

New World vultures and condors do not build nests, but lay eggs on bare surfaces. On average one to three eggs are laid, depending on the species. ^[27] Chicks are naked on hatching and later grow **down**. Like most birds the parents feed the young by **regurgitation**. ^[34] The young are **altricial**, fledging in 2 to 3 months. ^[33]

39.5 Status and conservation

The California condor is **critically endangered**. It formerly ranged from Baja California to British Columbia, but by 1937 was restricted to California. ^[18] In 1987, all surviving birds were removed from the wild into a captive breeding program to ensure the species' survival. ^[18] In 2005, there were 127 Californian condors in the wild. As of October 31, 2009 there were 180 birds in the wild. ^[43] The Andean condor is **near threatened**. ^[19] The American black vulture, turkey vulture, lesser yellow-headed vulture, and greater yellow-headed vulture are listed as species of Least Concern by the **IUCN Red List**. This means that populations appear to remain stable, and they have not reached the threshold of inclusion as a threatened species, which requires a decline of more than 30 percent in ten years or three generations. The king vulture is also listed as Least Concern, although there is evidence of a decline in the population. ^[44]


39.6 In culture

The American black vulture and the **king vulture** appear in a variety of **Maya** hieroglyphs in **Mayan codices**. The king vulture is one of the most common species of birds represented. ^[45] Its **glyph** is easily distinguishable by the knob on the bird's beak and by the concentric circles that represent the bird's eyes. ^[45] It is sometimes portrayed as a god with a human body and a bird head. ^[45] According to Mayan mythology, this god often carried messages between humans and the other gods. It is also used to represent Cozcaquauhtli, the thirteenth day of the month in the **Mayan calendar**. ^[45] In Mayan codices, the American black vulture is normally connected with death or shown as a bird of prey, and its glyph is often depicted attacking humans. This species lacks the religious connections that the king vulture has. While some of the glyphs clearly show the American black vulture's open nostril and hooked beak, some are assumed to be this species because they are vulture-like and painted black, but lack the king vulture's knob. ^[45]

39.7 See also

- Old World vultures
- Birds of prey


39.8 Notes

- [1] Jarvis, E. D.; Mirarab, S.; Aberer, A. J.; Li, B.; Houde, P.; Li, C.; Ho, S. Y. W.; Faircloth, B. C.; Nabholz, B.; Howard, J. T.; Suh, A.; Weber, C. C.; Da Fonseca, R. R.; Li, J.; Zhang, F.; Li, H.; Zhou, L.; Narula, N.; Liu, L.; Ganapathy, G.; Boussau, B.; Bayzid, M. S.; Zavidovych, V.; Subramanian, S.; Gabaldon, T.; Capella-Gutierrez, S.; Huerta-Cepas, J.; Rekepalli, B.; Munch, K.; et al. (2014). "Whole-genome analyses resolve early branches in the tree of life of modern birds" (PDF). *Science*. **346** (6215): 1320–1331. doi:10.1126/science.1253451. PMC 4405904  PMID 25504713.
- [2] Myers (2008)
- [3] Brookes (2006)
- [4] Phillips (2000)
- [5] Sibley and Ahlquist (1991)
- [6] de Boer (1975)
- [7] Ligon (1967)

- [8] König (1982)
- [9] Griffiths (1994)
- [10] Fain & Houde (2004)
- [11] Avise (1994)
- [12] Brown (2009)
- [13] Cracraft *et al.* (2004)
- [14] Gibb *et al.* (2007)
- [15] Ericson *et al.* (2006)
- [16] Hackett *et al.* (2008)
- [17] Griffiths, C. S.; Barrowclough, G. F.; Groth, J. G.; Mertz, L. A. (2007-11-06). “Phylogeny, diversity, and classification of the Accipitridae based on DNA sequences of the RAG-1 exon” . *Journal of Avian Biology*. **38** (5): 587–602. doi:10.1111/j.2007.0908-8857.03971.x.
- [18] BirdLife International (2009a)
- [19] BirdLife International (2009)
- [20] Mayr (2006)
- [21] Emslie (1988)
- [22] Wetmore, A. (1927). “Fossil Birds from the Oligocene of Colorado” (PDF). *Proceedings of the Colorado Museum of Natural History*. **7** (2): 1–14.
- [23] Stucchi (2005)
- [24] Suárez (2003)
- [25] Alvarenga (2004).
- [26] Suarez (2004)
- [27] Zim *et al.* (2001)
- [28] Reed (1914)
- [29] Ryser & Ryser (1985)
- [30] Krabbe (1990)
- [31] Feduccia (1999)
- [32] Kemp and Newton (2003)
- [33] Howell and Webb (1995)
- [34] Terres (1991)
- [35] Allaby (1992)
- [36] Fisher (1942)
- [37] Harris (2009)
- [38] Farmer (2008)
- [39] Snyder (2006)
- [40] Stone (1992)
- [41] Will Dunham (26 November 2014). “Gut check: how vultures dine on rotting flesh, and like it” . *Reuters*. Thomson Reuters. Retrieved 27 November 2014.
- [42] Michael Roggenbuck; Ida Bærholm Schnell; Nikolaj Blom; et al. (25 November 2014). “The microbiome of New World vultures” . *Nature Communications*. **5** (5498). doi:10.1038/ncomms6498.

- [43] “San Diego Zoo's Animal Bytes: California Condor” . The Zoological Society of San Diego's Center for Conservation and Research for Endangered Species. Retrieved 2009-12-29.
- [44] BirdLife International (2001)
- [45] Tozzer (1910)

39.9 References

- Allaby, Michael (1992). *The Concise Oxford Dictionary of Zoology*. Oxford: Oxford University Press ISBN 0-19-286093-3, p. 348
- Alvarenga, H. M F. & S. L. Olson. (2004). "A new genus of tiny condor from the Pleistocene of Brazil (Aves: Vulturidae)." *Proceedings of the Biological Society of Washington* **117**(1) 1 9
- American Ornithologists' Union (2009) Check-list of North American Birds, Tinamiformes to Falconiformes 7th Edition. AOU. Retrieved 6 October 2009
- American Ornithologists' Union (2010) Check-list of North American Birds, Tinamiformes to Falconiformes 7th Edition. AOU. Retrieved 3 August 2010
- Avise, J. C.; Nelson, W. S. & Sibley, C. G. (1994) "DNA sequence support for a close phylogenetic relationship between some storks and New World vultures" *Proc. Natl. Acad. Sci. USA* **91**(11): 5173–5177. doi:10.1073/pnas.91.11.5173 (PDF). Erratum, *PNAS* **92**(7); 3076 (1995). doi:10.1073/pnas.92.7.3076b
- BirdLife International (2004). *2001 Categories & Criteria (version 3.1)*. International Union for Conservation of Nature and Natural Resources. Retrieved 9 September 2007.
- BirdLife International (2009). "*Vultur gryphus*". *IUCN Red List of Threatened Species*. Version 2008. International Union for Conservation of Nature. Retrieved 6 October 2009.
- BirdLife International (2009a). "*Gymnogyps californianus*". *IUCN Red List of Threatened Species*. Version 2008. International Union for Conservation of Nature. Retrieved 6 October 2009.
- Brookes, Ian (editor-in-chief) (2006). *The Chambers Dictionary, ninth edition*. Edinburgh: Chambers. ISBN 0-550-10185-3. p. 238
- Brown J. W. & D. P. Mindell (2009) “Diurnal birds of prey (Falconiformes)” pp. 436–439 in Hedges S. B. and S. Kumar, Eds. (2009) *The Timetree of Life* Oxford University Press. ISBN 0-19-953503-5
- de Boer, L. E. M. (1975). “Karyological heterogeneity in the Falconiformes (Aves)”. *Cellular and Molecular Life Sciences*. **31** (10): 1138–1139. doi:10.1007/BF02326755. PMID 1204722.
- Campbell, Kenneth E. Jr.; Tonni, E. P. (1983). *Auk*. **100** (2): 390–403. Missing or empty |title= (help)
- Cracraft, J., F. K. Barker, M. Braun, J. Harshman, G. J. Dyke, J. Feinstein, S. Stanley, A. Cibois, P. Schikler, P. Beresford, J. García-Moreno, M. D. Sorenson, T. Yuri, and D. P. Mindell. (2004) “Phylogenetic relationships among modern birds (Neornithes): toward an avian tree of life.” pp. 468–489 in *Assembling the tree of life* (J. Cracraft and M. J. Donoghue, eds.). Oxford University Press, New York.
- Emslie, Steven D (1988). “An early condor-like vulture from North America” (PDF). *The Auk*. **105** (3): 529–535.
- Ericson, Per G. P.; Anderson, Cajsa L.; Britton, Tom; Elzanowski, Andrzej; Johansson, Ulf S.; Kallersjö, Mari; Ohlson, Jan I.; Parsons, Thomas J.; Zuccon, Dario; Mayr, Gerald (2006). “Diversification of Neoaves: integration of molecular sequence data and fossils” . *Biology Letters*. **2** (4): 543–7. doi:10.1098/rsbl.2006.0523. PMC 1834003 . PMID 17148284.
- Farmer A, Francl, K (2008) *Cathartes aura* University of Michigan Animal Diversity Web. Retrieved 8 October 2009
- Feduccia, J. Alan. (1999) *The Origin and Evolution of Birds* Yale University Press ISBN 0-226-05641-4 p. 300

- Fisher, Harvey I (1942). "The Pterylosis of the Andean Condor". *Condor*. **44** (1): 30–32. doi:10.2307/1364195.
- Gibb, G. C.; Kardailsky, O.; Kimball, R. T.; Braun, E. L.; Penny, D. (2007). "Mitochondrial genomes and avian phylogeny: complex characters and resolvability without explosive radiations". *Molecular Biology and Evolution*. **24**: 269–280. doi:10.1093/molbev/msl158. PMID 17062634.
- Harris, Tim (2009). *Complete Birds Of The World*. Washington D.C: National Geographic Society. ISBN 978-1-4262-0403-6. p. 72
- Hackett, Shannon J.; Kimball, Rebecca T.; Reddy, Sushma; Bowie, Rauri C. K.; Braun, Edward L.; Braun, Michael J.; Chojnowski, Jena L.; Cox, W. Andrew; Han, Kin-Lan; Harshman, John; Huddleston, Christopher J.; Marks, Ben D.; Miglia, Kathleen J.; Moore, William S.; Sheldon, Frederick H.; Steadman, David W.; Witt, Christopher C.; Yuri, Tamaki (2008). "A phylogenomic study of birds reveals their evolutionary history". *Science*. **320** (5884): 1763–68. doi:10.1126/science.1157704. PMID 18583609.
- Howell, Steve N.G., and Sophie Webb (1995). *A Guide to the Birds of Mexico and Northern Central America*. New York: Oxford University Press ISBN 0-19-854012-4, p. 174
- Kemp, Alan, and Ian Newton (2003): New World Vultures. In Christopher Perrins, ed., *The Firefly Encyclopedia of Birds*. Firefly Books. ISBN 1-55297-777-3. p. 146
- Krabbe, Niels & Fjeldså, Jon. 1990: *Birds of the High Andes*. Apollo Press ISBN 87-88757-16-1 p. 88
- Ligon, J. D. (1967). "Relationships of the cathartid vultures". *Occasional Papers of the Museum of Zoology, University of Michigan*. **651**: 1–26.
- Mayr, G (2006). "A new raptorial bird from the Middle Eocene of Messel, Germany" (PDF). *Historical Biology*. **18** (2): 95–102. doi:10.1080/08912960600640762.
- Myers, P., R. Espinosa, C. S. Parr, T. Jones, G. S. Hammond, and T. A. Dewey. (2008) Family Cathartidae University of Michigan Animal Diversity Web Retrieved 5 October 2009
- Phillips, Steven J, Comus, Patricia Wentworth (Arizona-Sonora Desert Museum) (2000) *A natural history of the Sonoran Desert* University of California Press ISBN 0-520-21980-5 p,377
- Reed, Chester Albert (1914): *The bird book: illustrating in natural colors more than seven hundred North American birds, also several hundred photographs of their nests and eggs*. University of Wisconsin. p. 198
- Remsen, J. V., Jr., C. D. Cadena, A. Jaramillo, M. Nores, J. F. Pacheco, M. B. Robbins, T. S. Schulenberg, F. G. Stiles, D. F. Stotz, and K. J. Zimmer. *A classification of the bird species of South America*. American Ornithologists' Union.
- Ryser Fred A. & A. Ryser, Fred Jr. 1985: *Birds of the Great Basin: A Natural History*. University of Nevada Press. ISBN 0-87417-080-X p. 211
- Sibley, Charles G. and Burt L. Monroe (1990) *Distribution and Taxonomy of the Birds of the World*. Yale University Press. ISBN 0-300-04969-2
- Sibley, Charles G., and Jon E. Ahlquist (1991) *Phylogeny and Classification of Birds: A Study in Molecular Evolution*. Yale University Press. ISBN 0-300-04085-7
- Snyder, Noel F. R. & Snyder, Helen (2006). *Raptors of North America: Natural History and Conservation*. Voyageur Press. ISBN 0-7603-2582-0 p. 40
- Stone, Lynn M. (1992) *Vultures* Rourke Publishing Group ISBN 0-86593-193-3 p. 14
- (Spanish) Stucchi, Marcelo; Emslie Steven D. (2005) "Un Nuevo Cóndor (Ciconiiformes, Vulturidae) del Mioceno Tardío-Plioceno Temprano de la Formación Pisco, Perú." *The Condor* **107**:(1) 107 113 doi:10.1650/7475
- Suárez, W.; Emslie, S.D. (2003). "New fossil material with a redescription of the extinct condor *Gymnogyps varonai* (Arredondo, 1971) from the Quaternary of Cuba (Aves: Vulturidae)" (PDF). *Proceedings of the Biological Society of Washington*. **116** (1): 29–37.
- Suarez, William (2004) "The identity of the fossil raptor of the genus *Amplibuteo* (Aves: Accipitridae) from the Quaternary of Cuba" *Caribbean Journal of Science* **40**: (1) 120 125

- Terres, J. K. & National Audubon Society (1991). *The Audubon Society Encyclopedia of North American Birds*. Reprint of 1980 edition. ISBN 0-517-03288-0 p 957
- Tozzer, Alfred Marston & Allen, Glover Morrill (1910). *Animal Figures in the Maya Codices*. Harvard University Plates 17 & 18
- Wink, M (1995). “Phylogeny of Old and New World vultures (Aves: Accipitridae and Cathartidae) inferred from nucleotide sequences of the mitochondrial cytochrome *b* gene” . *Zeitschrift für Naturforschung*. **50** (11–12): 868–882.
- Zim, Herbert Spencer; Robbins, Chandler S.; Bruun, Bertel (2001) *Birds of North America: A Guide to Field Identification* Golden Publishing. ISBN 1-58238-090-2

39.10 External links

- New World Vulture videos, photos and sounds on the Internet Bird Collection
- New World Vulture sounds on xeno-canto.org
- New World Vulture photos on beautyofbirds.com

Chapter 40

NIMBY



An airport is an example of a development that can cause a NIMBY reaction: though locals may benefit from improved transport links and new jobs, they may oppose it with objections to the noise, pollution and traffic it will generate.

NIMBY (an acronym for the phrase "**Not In My Back Yard**"^[1]^[2]), or **Nimby** (as a word, instead of an acronym),^[3] is a pejorative characterization of opposition by residents to a proposal for a new development because it is close to them (or, in some cases, because the development involves controversial or potentially dangerous technology) often with the connotation that such residents believe that the developments are needed in society but should be further away. The residents are often called Nimbys and their state of mind is called Nimbyism.

Examples of projects likely to be opposed include any sort of housing development,^[4] bicycle and pedestrian infrastructure, skyscrapers, homeless shelters,^[5] oil wells, chemical plants, industrial parks, military bases, fracking,^[6] wind turbines, desalination plants, landfill sites, incinerators, power plants, quarries, prisons,^[7] pubs, adult entertainment clubs, concert venues, firearms dealers, mobile phone masts, electricity pylons, abortion clinics,^[8] children's homes, nursing homes, youth hostels, sports stadiums, shopping malls, retail parks, railways, roads, airports, seaports, nuclear waste repositories,^[9] storage for weapons of mass destruction,^[10] cannabis dispensaries and recreational cannabis shops.

The NIMBY concept may also be applied to people who advocate some proposal (e.g., budget cuts, tax increases, layoffs, immigration or energy conservation) but oppose implementing it in a way that might affect their lives or



Unfinished tower in Tenleytown, Washington, D.C. that was later removed as a result of complaints from the neighborhood

require any sacrifice on their part.

40.1 Claimed rationale

Developments likely to attract local objections include:

- Infrastructure development, such as new roads and motorway service areas, light rail and metro lines, bicycle and pedestrian infrastructure, airports, power plants, retail developments, sales of public assets, electrical transmission lines, wastewater treatment plants, landfills, sewage outfalls and prisons;
- The extraction of mineral resources including ore, aggregates and hydrocarbons from mines, quarries and oil wells or gas wells, respectively;
- renewable energy generators, such as wind farms and solar panels;
- businesses trading in goods perceived as immoral, such as adult video, liquor stores, and medical cannabis dispensaries;
- accommodations perceived as primarily benefitting disadvantaged people, such as subsidized housing for the financially disadvantaged, supportive housing for the mentally ill, halfway houses for drug addicts and criminals, and homeless shelters for those with no fixed address;
- services catering to certain stigmatised groups (for example, injection drug users), such as methadone clinics, syringe exchange programmes, drug detoxification facilities, pawn shops; and
- large-scale developments of all kinds, such as big box stores and housing subdivisions.

The claimed reasons against these developments vary, and some are given below.

- *Increased traffic:* More jobs, more housing or more stores correlates to increased traffic on local streets and greater demand for parking spots. Industrial facilities such as warehouses, factories, or **landfills** often increase the volume of truck traffic.
- *Harm to locally owned **small businesses**:* The development of a big box store may provide too much competition to a locally owned store; similarly, the construction of a new road may make the older road less travelled, leading to a loss of business for property owners. This can lead to excessive relocation costs, or to loss of respected local businesses.
- *Loss of residential property value:* Homes near an undesirable development may be less desirable for potential buyers. The lost revenue from property taxes may, or may not, be offset by increased revenue from the project.
- ***Environmental pollution of land, air, and water:*** Power plants, factories, chemical facilities, **crematoriums**, **sewage treatment facilities**, airports, and similar projects may, or may be claimed to, contaminate the land, air, or water around them. Especially facilities assumed to smell might cause objections.
- ***Light pollution:*** Projects that operate at night, or that include security lighting (such as street lights in a parking lot), may be accused of causing light pollution.
- ***Noise pollution:*** In addition to the noise of traffic, a project may inherently be noisy. This is a common objection to **wind power**, **airports**, roads, and many industrial facilities, but also stadiums, **festivals**, and **nightclubs** which are particularly noisy at night when locals want to sleep.*[11]
- ***Visual blight and failure to “blend in” with the surrounding architecture:*** The proposed project might be ugly or particularly large, or cast a **shadow** over an area due to its height.*[12]
- ***Loss of a community's **small-town feel**:*** Proposals that might result in new people moving into the community, such as a plan to build many new houses, are often claimed to change the community's character.
- ***Strain of public resources and schools:*** This reason is given for any increase in the local area's population, as additional school facilities might be needed for the additional children, but particularly to projects that might result in certain kinds of people joining the community, such as a **group home** for people with disabilities, or immigrants.
- ***Disproportionate benefit to non-locals:*** The project appears to benefit distant people, such as investors (in the case of commercial projects like factories or big-box stores) or people from neighboring areas (in the case of regional government projects, such as airports, highways, sewage treatment, or landfills).
- ***Increases in crime:*** This is usually applied to projects that are perceived as attracting or employing low-skill workers or racial minorities, as well as projects that cater to people who are thought to often commit crimes, such as the mentally ill, the poor, and drug addicts. Additionally, certain types of projects, such as **pubs** or **medical marijuana** dispensaries, might be perceived as directly increasing the amount of crime in the area.
- ***Risk of an (environmental) disaster,*** such as with drilling operations, chemical industry, **dams**,*[13] or nuclear power plants.

Generally, many NIMBY objections are guessed or feared, because objections are more likely to be successful before the construction start. It is often too late to object to the project after its completion, since new additions are unlikely to be reversed. As hinted by the list, protests can occur for opposite reasons. A new road or shopping center can cause increased traffic and work opportunities for some, and decreased traffic for others, harming local businesses.

People in an area affected by plans sometimes form an organization which can collect money and organize the objection activities. NIMBYists can hire a lawyer to do formal **appeals**, and contact media to gain public support for their case.

40.2 Origin and history

The *Oxford English Dictionary* identifies the acronym's earliest use as being in 1980 in the *Christian Science Monitor*, although even there the author indicates the term is already used in the hazardous waste industry.*[14]*[15] The concept behind the term, that of locally organized resistance to unwanted land uses, is likely to have originated earlier. One suggestion is it emerged in the 1950s.*[16]

In the 1980s, the term was popularized by British politician **Nicholas Ridley**, who was **Conservative Secretary of State for the Environment**. Comedian **George Carlin** used the term in a comedy skit, implying that people had already heard of it.*[17]

40.3 Variations

NIMBY and its derivative terms *NIMBYism*, *NIMBYs*, and *NIMBYists*, refer implicitly to debates of development generally or to a specific case. As such, their use is inherently contentious. The term is usually applied to opponents of a development, implying that they have narrow, selfish, or myopic views. Its use is often pejorative.*[18]

40.3.1 Not in My Neighborhood

The term *Not in My Neighborhood* (or *NIMN*) is also frequently used.*[19] “NIMN” additionally refers to legislative actions or private agreements made with the sole purpose of maintaining racial identity within a particular neighborhood or residential area by forcefully keeping members of other races from moving into the area.*[20] In that regard, “Not in My Neighborhood,” by author and journalist Antero Pietila, describes the toll NIMN politics had on housing conditions in Baltimore throughout the 20th century and the systemic, racially based citywide separation it caused.*[21]

40.3.2 NIABY

Opposition to certain developments as inappropriate anywhere in the world is characterised by the acronym *NIABY* (“Not In Anyone's Backyard”). The building of **nuclear power plants**, for example, is often subject to NIABY concerns.*[22]

40.3.3 NAMBI

NAMBI (“Not Against My Business or Industry”) is used as a label for any business concern that expresses umbrage with actions or policy that threaten that business, whereby they are believed to be complaining about the principle of the action or policy only for their interests alone and not for all similar business concerns who would equally suffer from the actions or policies.*[22] The term serves as a criticism of the kind of outrage that business expresses when disingenuously portraying its protest to be for the benefit of all other businesses. Such a labelling would occur, for example, when opposition expressed by a business involved in urban development is challenged by activists – causing the business to in turn protest and appealing for support from fellow businesses lest they also find themselves challenged where they seek urban development. This term also serves as a rhetorical counter to NIMBY. Seen as an equivalent to NIMBY by those opposing the business or industry in question.

40.3.4 BANANA

BANANA is an acronym for “Build Absolutely Nothing Anywhere Near Anything” (or “Anyone”).*[23]*[24] The term is most often used to criticize the ongoing opposition of certain **advocacy groups** to **land development**.*[25] The apparent opposition of some **activists** to every instance of proposed development suggests that they seek a complete absence of new growth. The term is commonly used within the context of **planning** in the **United Kingdom**. The **Sunderland City Council** lists the term on their online dictionary of jargon.*[26]

40.3.5 PIBBY

PIBBY is an acronym for “Place In Blacks' Back Yard.” This principle indicates that the people with social, racial, and economic privileges object to a development in their own back yards, and if the objectionable item must be built, then it should be built so that its perceived harms disproportionately affect poor, socially disadvantaged people. Economically disadvantaged people might not want to hire a lawyer to appeal the right way, or might have more immediate troubles than a new nearby construction project. The **environmental justice** movement has critiqued Nimbyism as a form of **environmental racism**. **Robert D. Bullard**, Director of the Environmental Justice Resource Center at Clark Atlanta

University, has argued that official responses to NIMBY phenomena have led to the PIBBY principle.*[27]*[28]*[29]*[30]*[31]*[32]*[33]*[34]

40.3.6 FRUIT

FRUIT is an acronym for “Fear of Revitalization Urban-Infill and Towers” . The word *FRUIT* or *FRUITs* is a play on words in support of the acronym *BANANAs*. First used in a development industry article in Vancouver to refer to allegedly irrational local opponents (fruit cakes, fruit loops or just fruits) of well-planned developments.*[35]

40.3.7 SOBBY

SOBBY is an acronym for “Some Other Bugger's Back Yard” and refers to the state of mind which agrees that a particular project may be desirable and perhaps necessary – but only if it is placed somewhere else.*[36]

40.4 Points of debate

Although often used rather pejoratively, the use of the concept NIMBY and similar terms have been critiqued. For instance, the term is frequently used to dismiss groups as selfish or ill-informed, yet these same groups may have virtues that are overlooked.*[37]

40.4.1 In favor of development

Frequently argued debate points in favor of development include higher employment, tax revenue, marginal cost of remote development, safety, and environmental benefits. Proponents of development may accuse locals of *egotism*, *elitism*, *parochialism*, *drawbridge mentality*, *racism* and *anti-diversity*, the inevitability of criticism, and misguided or unrealistic claims of prevention of *urban sprawl*. If people who don't want to be disturbed see the general need of an establishment, such as an airport, they generally suggest another location. But seen from society's perspective, the other location might not be better, since people living there get disturbed instead.*[38]

40.4.2 In favor of local sovereignty

Those labeled as NIMBYs may have a variety of motivations and may be unified only because they oppose a particular project. For example, some may oppose any significant change or development, regardless of type, purpose, or origin. Others, if the project is seen as being imposed by outsiders, may hold strong principles of *self-governance*, *local sovereignty*, *local autonomy*, and *home rule*. These people believe that local people should have the final choice, and that any project affecting the local people should clearly benefit themselves, rather than corporations with distant investors or central governments.*[39] Still others may object to a particular project because of its nature, e.g., opposing a nuclear power plant over fear of radiation, but accepting a local *waste management* facility as a municipal necessity.

40.5 Examples

40.5.1 Canada

Nova Scotia

In July 2012, residents of Kings County rallied against a bylaw, developed over three years of consultation and hearings, allowing wind generators to be constructed nearby.*[40] A similar theme arose in September 2009, where residents there rallied against a wind generator in Digby Neck, Nova Scotia.*[41] In January 2011, residents of Lawrencetown, NS openly opposed a cell tower being built.*[42] A proposed development of downtown Dartmouth in August 2012 was also contested by residents.*[43] In February 2013, some residents of Lunenburg County opposed

wind farms being built in the area, saying, “It’s health and it’s property devaluation” and “This is an industrial facility put in the middle of rural Nova Scotia. It does not belong there.”*[44]

In March 2013, some residents of the community of Blockhouse opposed the building and development of a recycling plant, referred to by one business owner as a “dump.” The plant would offer 75 jobs to the community of roughly 5,900 people.*[45] In the same month, the municipal councilors of Chester, Nova Scotia, approved the building of wind turbines in the area in a 6-1 vote, despite some local opposition.*[46]

40.5.2 United Kingdom

Ashtead, Surrey

In the affluent English village of Ashtead, Surrey, which lies on the outskirts of London, residents objected in 2007*[47] to the conversion of a large, £1.7 million residential property into a family support centre for relatives of wounded British service personnel. The house was to be purchased by a registered charity, SSAFA Forces Help.*[47]*[48]*[49] Local residents objected to the proposal out of fear of increased traffic and noise, as well as the possibility of an increased threat of terrorism. They also contended that the SSAFA charity is actually a business, thereby setting an unwelcome precedent.*[50] Local newspapers ran articles titled “Nimby neighbours’ war with wounded soldiers’ families” and “No Heroes in my Backyard.”

Ex-servicemen and several members of the British general public organised a petition in support of SSAFA, and even auctioned the “Self Respect of Ashtead” on eBay.*[51]

High Speed 2

Particularly in the run up to the final decision on the route of the high-speed railway known as High Speed 2, BBC News Online reported that many residents of Conservative constituencies were launching objections to the HS2 route based on the effects it would have on them, whilst also showing concerns that HS2 is unlikely to have a societal benefit at a macro level under the current economic circumstances.*[52]*[53] Likewise, Labour MP Natascha Engel—through whose constituency the line will pass—offered a “passionate defence of nimbyism” in the House of Commons, with regards to the effects the line would have on home- and business-owning constituents.*[54] HS2 has also been characterised by residents of the Chilterns and Camden making arguments against the supposed lack of a business case for the line, often as a smokescreen for NIMBYism. On 17 March 2014, it was announced that Camden’s NIMBYs were successful in their campaign to derail the HS1-HS2 link railway.

Heathrow Airport

In November 2007 a consultation process began for the building of a new third runway and a sixth terminal and it was controversially*[55] approved on 15 January 2009 by UK Government ministers.*[56] The project was then cancelled on 12 May 2010 by the Cameron Government.*[57]

Heathrow Airport has a CAA Public Use Aerodrome Licence (Number P527) that allows flights for the public transport of passengers or for flying instruction.*[58]

Coventry Airport

The airport is owned by CAFCO (Coventry) Limited, a joint venture between Howard Holdings plc*[59] and Convergence-AFCO Holdings Limited (CAFCOHL), and in June 2007 had its application to build permanent terminal and passenger facilities turned down by the UK government due to public pressure.*[60]*[61]*[62]*[63]*[64]*[65]

Wimbledon, London

The London Borough of Merton did not have enough school places for local children who would be reaching school age in 2012 and 2013. Almost all local schools had expanded, but the NIMBY group “Save Our Rec” opposed the expansion of Dundonald school onto the site of the nearby park’s pavilion.*[66]

40.5.3 Hong Kong

When Christian Zheng Sheng College, a correctional school for young drug addicts, opened in 1998, several people called it an eyesore. In June 2009, residents of Mui Wo voiced objection when they announced they are planning to move their campus into an empty school building there.

40.5.4 Italy

The No TAV opposition to the Turin–Lyon high-speed railway is often characterized as a NIMBY movement.

40.5.5 Japan

The Muraiken Undō or No Leprosy Patients in Our Prefecture Movement, was a government funded Japanese public health and social movement which began between 1929 and 1934.

In 2001, when the leprosy prevention law was ruled unconstitutional, the Prime Minister, the Minister of Welfare, and the National Diet published statements of apology to leprosy patients and their families. Several prefectural governors made apologies at public sanatoriums.

40.5.6 United States

California

A small number of residents (mostly farmers) in Hanford, California and surrounding areas are opposed to the California High-Speed Rail Authority building high-speed rail near farmland, citing that it will bring environmental and economic problems.

Wealthy residents of southern Orange County, CA defeated a local measure that proposed to convert the decommissioned El Toro Marine Base into a commercial airport, claiming that the airport would be “unsafe” during landings and take-offs as well as create air quality issues. The real issue was the FAA planned the flight paths for the airport over expensive neighborhoods of the south Orange County and residents feared that their property values would decrease. The airport proposal, however, was strongly supported by Northern Orange County residents. The defeat of the local measure resulted in the creation of the Orange County Great Park.

National, state and local environmentalists, historic preservationists and long time residents of South Pasadena, California have been successfully opposing the completion of the highly controversial State Route 710 through the cities of Los Angeles (El Sereno), South Pasadena and Pasadena for over 60 years. There has been a federal injunction in place for 41 years stopping construction of the surface freeway. USC and UCLA urban and transportation planning students study this 80-year-old controversy because it is a classic example of sustained grass-roots opposition to a government proposal.

Now and for over a decade, a struggle has been brewing in San Francisco, California between the voting public and the influx of young professionals and tech workers. With no room to expand, construction companies can only build up in order to meet the increasing housing demand. However, NIMBYism has prevented high rise construction from spreading in San Francisco, citing restrictions on buildings' shadows and the dramatic changes proposed to the waterfront skyline.*[67] The opposition argues that new construction will increase the supply of luxury housing without creating affordable housing, thus raising the average rent while by attracting a wealthier population to the city of San Francisco and forcing middle and lower income families out of the city.*[68]

Florida

Similar to the situation in Nantucket Sound, Mass., a minority of residents in St. Lucie County, Florida have vehemently opposed the construction of wind turbines in the county. The construction of the wind turbines is strongly supported by over 80% of county residents according to a 2008 Florida Power and Light (FPL) poll.*[69] Additionally, the power company proposed building the turbines in a location on a beach near a prior existing nuclear power plant owned by the company.

In the 1980s, a agency known as the Palm Beach County Expressway Authority was formed to develop a series of east/west highways to take people from suburban Palm Beach County into downtown **West Palm Beach**. This was done in anticipation of **population growth** that would happen over the next decades in Palm Beach County that would bring in more traffic. Many neighbors in areas such as Westgate and Lake Belvedere Estates strongly opposed this plan citing it would wipe out their neighborhoods. Ultimately the plan was revised to create **SR-80** Boulevard into an express like roadway by eliminating traffic lights and overpassing other local roadways.

Illinois

In 1959, when **Deerfield** officials learned that a developer building a neighborhood of large new homes planned to make houses available to **African Americans**, they issued a stop-work order. An intense debate began about racial integration, property values, and the good faith of the residents, community officials and builders. For a brief time, Deerfield was spotlighted in the national news as “the Little Rock of the North.” ^[70] Supporters of integration were denounced and ostracized by residents. Eventually, the village passed a referendum to build parks on the property, thus putting an end to the housing development. Two model homes already partially completed were sold to village officials. ^[70] Otherwise, the land lay dormant for years before it was developed into what is now Mitchell Pool and Park and Jaycee Park. The first black family did not move into Deerfield until much later, and in years since Deerfield has seen a greater influx of minorities, including Jews, Asians, Greeks and others. This episode in Deerfield's history is described in *But Not Next Door* by Harry and David Rosen, both residents of Deerfield.

Massachusetts

Opposition to two proposed freeways within the **MA Route 128** beltway road around Boston - the **Inner Belt** and the routing of **Interstate 95** in Massachusetts into downtown Boston via the **Southwest Corridor** - were opposed from their proposals during the 1950s era, and finally cancelled by the actions of then-Governor **Francis Sargent** in 1970. The **MBTA Orange Line** heavy rail rapid transit line's southern route was eventually re-located along much of the Southwest Corridor right-of-way for the cancelled I-95's roadbed in the late 1980s, when the Orange Line's **Washington Street Elevated** tracks were torn down at the time.

Some residents and businesses of **Cape Cod**, **Martha's Vineyard**, and **Nantucket Island** have opposed construction of **Cape Wind**, a proposed offshore wind farm in **Nantucket Sound**. Proponents cite the environmental, economic, and **energy security** benefits of clean, **renewable energy**, while opponents are against any obstruction to the views from oceanfront vacation homes and tourist destinations based in the region.

Minnesota

In the late 1990s a proposal for **commuter rail** on the **Dan Patch Corridor** between **Minneapolis** and **Northfield** was studied. In 2002, due to opposition from neighborhoods along the corridor, two state representatives from the suburbs of **Bloomington** and **Edina** passed a legislative ban not allowing further study, discussion, funding, and construction of the project. While the ban is still in place despite numerous attempts to repeal it, the two suburbs that sponsored the ban are now open to the proposal. **Lakeville** and **St. Louis Park** remain opposed to the project and repealing the ban.

New York

In **Long Island**, various electrification and expansion projects of the **Long Island Rail Road** were canceled or substantially delayed due to the protests of people living near the railroad.

For example, portions of the LIRR's **Main Line** were supposed to get a third track to accommodate an expected increase in Long Island Rail Road ridership once the **East Side Access** project to **Grand Central Terminal** is completed, as well as to expand local and reverse peak service. The Metropolitan Transportation Authority had proposed to build a third Main Line track from **Floral Park** to **Hicksville** in the future. ^[71]^[72] Components of the project included purchasing properties in the track's right of way, eliminating grade crossings (in conjunction with **NYSDOT**), relocating existing stations, and reconfiguring **Mineola Station**. Fierce opposition for building a third track came from the villages of **Floral Park**, **New Hyde Park**, and **Garden City**, ^[73]^[74]^[75] which said the construction and the resulting increased train service will reduce the quality of life in their neighborhoods. The third track project was suspended indefinitely in 2008, but the MTA stressed that it was committed to eventually building the third track as

a necessary part of the East Side Access project. * [76] New funding for the project was included in a 2016 infrastructure improvement plan announced by New York Governor Andrew Cuomo. * [77] Governor Cuomo's announcement described measures intended to mitigate locals' concerns, including a change to the design so that it would require using land on only 50 properties including 20 homes, instead of the over 200 properties and 80 homes that would have been impacted under previous versions of the plan. * [77] Despite the promise of mitigation efforts, several local politicians denounced the governor's plan within a day of its announcement; Floral Park's mayor told the *New York Times* that “we thought this was dead and buried” , * [78] while New Hyde Park's mayor pledged to “fight the governor vehemently on this” and a local state senator called the governor's plan “dead on arrival.” * [79]

In Port Washington, New York, a dispute broke out between the town of North Hempstead and the LIRR over a proposed yard expansion of Port Washington. To expand the yard, a parking lot belonging to the town would need to be made smaller by 40 parking spaces. Local Councilwoman Dina De Giorgio opposed the plan, saying that “The idea of storing these massive trains, adding two storage tracks to Port Washington, will completely ruin the character of the town.” * [80] However, the LIRR would be able to expand the yard without the agreement of North Hempstead by tearing up 140 parking spaces of its own parking lot, also adjacent to the station. * [80]

Similarly, opposition has killed any proposal to build a bridge or tunnel across the Long Island Sound with some believing it will harm their communities with an influx of unwanted traffic as well as concerns regarding the environment and the amount of homes that would be cleared as a result. * [81]

40.6 See also

- CAVE People
- *Citizens to Preserve Overton Park v. Volpe*
- Drawbridge mentality
- Eyesore
- Fenno's paradox
- Freeway revolt
- Locally unwanted land use (LULU)
- Luddite
- Pulp mill conflict between Argentina and Uruguay
- Smart Growth
- Somebody Else's Problem
- Technophobia
- YIMBY
- Waste
- Wind farm opposition

40.7 References

- [1] “Cambridge Dictionaries Online - meaning of NIMBY” . Retrieved 17 July 2015.
- [2] “Oxford Dictionaries - definition of Nimby” . Retrieved 17 July 2015.
- [3] “Definition of Nimby” . Macmillan Dictionary. Retrieved 17 July 2015.
- [4] Matthew Holehouse (July 23, 2014). “Boris Johnson: Nimbies pretend to care about architecture to block developments” . *The Telegraph*. Retrieved January 23, 2016.

- [5] Andrew Galvin (August 28, 2015). "Anywhere but here" . *OC Weekly*. Retrieved January 23, 2016.
- [6] Patrick Wintour (August 4, 2013). "Fracking will meet resistance from southern nimbys, minister warns" . *The Guardian*. Retrieved January 23, 2016.
- [7] "Dictionary and Thesaurus - Merriam-Webster" . Retrieved 15 September 2016.
- [8] Marcotte, Amanda (March 24, 2013). "What North Dakota and Mississippi Reveal About Anti-Choice NIMBYism and Hypocrisy" . *RH Reality Check*.
- [9] James Kanter (November 7, 2007). "Radioactive Nimby: No one wants nuclear waste" . *The New York Times*. Retrieved January 23, 2016.
- [10] Mick Common (August 24, 2014). "Trident removal is a Nimby position" . *The Herald*. Scotland. Retrieved January 23, 2016.
- [11] http://www.todayszaman.com/national_nightclub-music-needs-restricting-to-reduce-noise-pollution-say-environmentalists_215054.html
- [12] Curbed (20 February 2014). "Hundreds Fret About Superscrapers' Shadows As Extell Rebutts" . Retrieved 15 September 2016.
- [13] Hager, Carol; Haddad, Mary Alice (30 March 2015). "Nimby Is Beautiful: Cases of Local Activism and Environmental Innovation Around the World" . Berghahn Books. Retrieved 15 September 2016 – via Google Books.
- [14] Spy, Word. "NIMBY - Word Spy" . Retrieved 15 September 2016.
- [15] Livezey, Emilie Travel (6 November 1980). "Hazardous waste" . Retrieved 15 September 2016 – via Christian Science Monitor.
- [16] Maiorino, Al. (22 March 2011) "Do You Have Control Over NIMBYism?" *Biomass Magazine*
- [17] "George Carlin on N.I.M.B.Y." (video). *YouTube*. Retrieved 25 April 2012. We {{sic}} got somethin' in this country (you've heard of it) -- it's called NIMBY -- n-i-m-b-y -- Not In My BackYard!
- [18] You can' t park here: it' s my retreat, says 'Nimby' Clooney (The Times)
- [19] Hull, Jon (25 January 1988). "Not In My Neighborhood" . *Time*. Time Inc. Retrieved 20 May 2010.
- [20] Scharper, Diane (March 21, 2010). "Ex-Sun author traces bigotry's role in shaping Baltimore" . *The Baltimore Sun*.
- [21] Pietila, Antero (2010). *Not in my neighborhood : how bigotry shaped a great American city*. Chicago: Ivan R. Dee. ISBN 1566638437.
- [22] translationconference.com
- [23] "Absolute Banana" . *The New York Times*. 23 December 1993. Retrieved 15 September 2016.
- [24] "From NIMBYs To DUDEs: The Wacky World Of Plannerese" . Retrieved 15 September 2016.
- [25] BANANA at Wordspy
- [26] "Sunderland City Council" . Retrieved 15 September 2016.
- [27] Stewart, James B. (5 April 2002) Book Reviews: "Dumping in dixie: Race, class, and environmental quality" *The Review of Black Political Economy* Volume 20, Number 2, 105-107, doi:10.1007/BF02689929
- [28] Bullard, Robert D. (2008-03-31). *Dumping in Dixie: Race, Class, and Environmental Quality*. Westview Press. p. 4. ISBN 0813344271.
- [29] "Put It In Blacks Backyard" . *Alternet*.
- [30] "Beyond Resistance! Youth Activism and Community Change: New Democratic ... edited by Pedro Noguera, Julio Cammarota, Shawn Ginwright" . *Google books*.
- [31] "Black environmentalists go after PIBBY - 'put it in blacks' backyards" . *AthensNews*.
- [32] "Integrating Environment and Economy: Strategies for Local and Regional Government edited by Andrew Gouldson, Peter Roberts" . *Google Books*.
- [33] "PIBBY" . *The Free Dictionary*.

- [34] "Book Reviews: American Politics The Evolving Citizen: American Youth and the Changing Norms of Democratic Engagement. By Jay P. Childers. University Park, PA: The Pennsylvania State University Press" . *Perspectives on Politics*.
- [35] "Why Gen Y Can't Buy - The Carpenter | URBAN DEVELOPMENT INSTITUTE" . Udi.bc.ca. Retrieved 7 March 2014.
- [36] Walter, Liz (3 March 2014). "Move over Yuppies - the Magpies have arrived" . *dictionaryblog.cambridge.org*. Cambridge Dictionaries Online. Retrieved 13 August 2015.
- [37] Mcclymont, Katie; O'hare, Paul (2008-06-01). ""We're not NIMBYs!" Contrasting local protest groups with idealised conceptions of sustainable communities" . *Local Environment*. **13** (4): 321–335. doi:10.1080/13549830701803273. ISSN 1354-9839.
- [38] Gerdner, A. & Borell, K. 2003. Neighbourhood Reactions toward Facilities for Residential Care: A Swedish Survey Study. *Journal of Community Practice* 11(4):59-81
- [39] *The Impact of Corporations on the Commons*, Address by Mary Zepernick at the Harvard Divinity School's Theological Opportunities Program, 21 October 2004, poclad.org
- [40] Delaney, Gordon (7 July 2012). "Which way does the wind blow? | The Chronicle Herald" . Thechronicleherald.ca. Retrieved 7 March 2014.
- [41] "NIMBY Neck – updated : Contrarian" . Contrarian.ca. 9 September 2009. Retrieved 7 March 2014.
- [42] "Cell tower opposed in Lawrencetown - Nova Scotia - CBC News" . Cbc.ca. 25 January 2011. Retrieved 7 March 2014.
- [43] Croucher, Philip (29 August 2012). "Public hearing Thursday for planned downtown Dartmouth development | Metro" . Metronews.ca. Retrieved 7 March 2014.
- [44] "Lunenburg County debates province's largest wind farm - Nova Scotia - CBC News" . Cbc.ca. 5 March 2013. Retrieved 7 March 2014.
- [45] "Negative feedback towards new development in N.S. community | CTV Atlantic News" . Atlantic.ctvnews.ca. 11 March 2013. Retrieved 7 March 2014.
- [46] "Chester approves Nova Scotia's largest wind farm - Nova Scotia - CBC News" . Cbc.ca. 15 March 2013. Retrieved 7 March 2014.
- [47] "No heroes in my backyard" . Retrieved 15 September 2016.
- [48] *Headley Court Families Accommodation* (SSAFA Forces Help)
- [49] "Smart school uniforms linked to academic success of UK's schools" . Retrieved 15 September 2016.
- [50] "Page Not Found" . Retrieved 15 September 2016.
- [51] Woods, Vicki (28 July 2007). "Legless boys' mammas? Not in Ashtead" . *telegraph.co.uk*. London. Retrieved 7 June 2010.
- [52] "The farm lying in the path of the new rail route" . 20 December 2010. Retrieved 15 September 2016 – via www.bbc.co.uk.
- [53] "Tory vs Tory on high speed rail" . Retrieved 15 September 2016 – via www.bbc.co.uk.
- [54] Natascha Engel (26 June 2013). <http://www.publications.parliament.uk/pa/cm201314/cmhansrd/chan24.pdf> [chapter-url= missing title (help) (PDF)]. *Parliamentary Debates (Hansard)*. **565**. House of Commons. col. 378–380.
- [55] "Britain: Third Heathrow runway approved despite opposition - CNN.com" . *CNN*. 15 January 2009. Retrieved 11 May 2010.
- [56] "BBC News - Go-ahead for new Heathrow runway" . Retrieved 15 September 2016.
- [57] "BBC News - Heathrow runway plans scrapped by new government" . Retrieved 15 September 2016.
- [58] "Page not found - UK Civil Aviation Authority" (PDF). Retrieved 15 September 2016.
- [59] "Howardholdings.com" . Retrieved 15 September 2016.
- [60] "Shock Rejection Hits Plan for Coventry Airport Terminal" . Retrieved 15 September 2016.
- [61] Herbert, Ian (10 July 2007). "Grounded: Another victory in battle to curb airport growth" . *The Independent*. London.
- [62] Warwickdc.gov.uk

- [63] “Birmingham Post politics news plus reports council and Government issues affecting Birmingham, the Black Country and the West Midlands” . Retrieved 15 September 2016.
- [64] Docs.google.com
- [65] “Breaking News - Coventry Airport Goes Bust And Shuts - House prices and the economy” . Retrieved 15 September 2016.
- [66] “London's public open space sold off - YouTube” . youtube.com. Retrieved 14 September 2014.
- [67] Dineen, J.K. “NIMBYs are back: S.F. builders face growing backlash” . *NIMBYs are back: S.F. builders face growing backlash*. “Biz Journals” . Retrieved 6 January 2014.
- [68] Sankin, Aaron (20 July 2012). “8 Washington Luxury Waterfront Condo Development Project Vote Likely To Make It Onto November Ballot” . *Huffington Post*. Retrieved 29 January 2014.
- [69] “Page not found - www.palmbeachpost.com”. Retrieved 15 September 2016.
- [70] Rosen, Harry; David Rosen (1962). *But Not Next Door*. Astor-Honor Inc. ISBN 0-8392-1007-8.
- [71] Main Line Corridor Improvements EIS
- [72] “Home-2016-6-13” . Retrieved 15 September 2016.
- [73] Stephanie Mariel Petrellese (11 November 2005). “Floral Park Mayor To Address LIRR Expansion” . The Garden City News. Retrieved 23 December 2006.
- [74] Carisa Keane (24 June 2005). “Residents: MTA/LIRR Needs to Get on Right Track” . New Hyde Park Illustrated News. Retrieved 23 December 2006.
- [75] Stephanie Mariel Petrellese (15 December 2006). “Village Meets With LIRR On “Third Track” Project” . The Garden City News. Retrieved 23 December 2006.
- [76] Nardiello, Carolyn (16 September 2008). “Third-Track Plan Isn’ t Dead, L.I.R.R. Insists” . The New York Times. Retrieved 31 July 2012.
- [77] Madore, James T. (2016-01-05). “Andrew Cuomo tells Long Island Association he’ ll push LIRR third track, LI Sound tunnel” . Newsday. Retrieved 2016-01-07.
- [78] Fitzsimmons, Emma G. (2016-01-05). “Cuomo Revives Long-Stalled Plan to Add Track to L.I.R.R.” . The New York Times. p. A18. Retrieved 2016-01-07.
- [79] Manskar, Noah (2016-01-07). “Cuomo revives LIRR third track plans” . The Island Now. Retrieved 2016-01-08.
- [80] “LIRR plan would run more trains to NYC” . Newsday. 14 May 2013. Retrieved 7 March 2014.
- [81] Andersen, Steve; Herman, Ralph; Willinger, Douglas A.; Schlichtman, Paul. “Overview: Oyster Bay-Rye Bridge (I-287, unbuilt)”.

40.8 External links

- Multifamily Housing Group Targets NIMBY
- Saint Index strives to measure Nimbyism
- Nimby Wars from Forbes Magazine
- How to Overcome NIMBY Opposition to Your Project
- Q & A with NIMBY Expert Debra Stein

Chapter 41

OODA loop

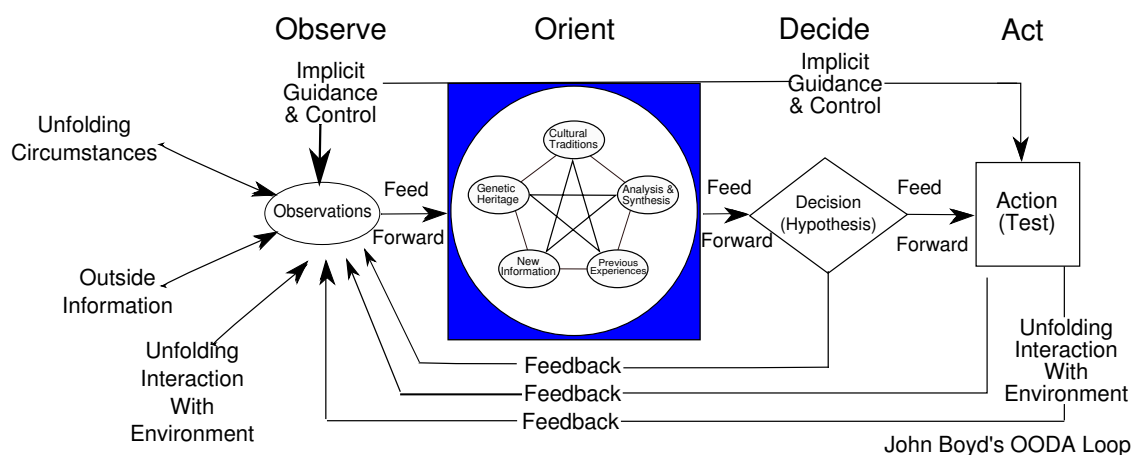


Diagram of a decision cycle known as the Boyd cycle, or the OODA loop

The phrase **OODA loop** refers to the decision cycle of *observe, orient, decide, and act*, developed by military strategist and United States Air Force Colonel John Boyd. Boyd applied the concept to the combat operations process, often at the strategic level in military operations. It is now also often applied to understand commercial operations and learning processes. The approach favors agility over raw power in dealing with human opponents in any endeavor.

41.1 Overview

The OODA loop has become an important concept in litigation,^[1] business,^[2] law enforcement,^[3] and military strategy. According to Boyd, decision-making occurs in a recurring cycle of observe-orient-decide-act. An entity (whether an individual or an organization) that can process this cycle quickly, observing and reacting to unfolding events more rapidly than an opponent can thereby “get inside” the opponent's decision cycle and gain the advantage. Frans Osinga argues that Boyd's own views on the OODA loop are much deeper, richer, and more comprehensive than the common interpretation of the “rapid OODA loop” idea.^[4]

Boyd developed the concept to explain how to direct one's energies to defeat an adversary and survive. Boyd emphasized that “the loop” is actually a set of interacting loops that are to be kept in continuous operation during combat. He also indicated that the phase of the battle has an important bearing on the ideal allocation of one's energies.

Boyd's diagram shows that all decisions are based on observations of the evolving situation tempered with implicit filtering of the problem being addressed. The observations are the raw information on which decisions and actions are based. The observed information must be processed to orient it for decision making. In notes from his talk “Organic Design for Command and Control”, Boyd said,

The second O, orientation—as the repository of our genetic heritage, cultural tradition, and previous

experiences—is the most important part of the O-O-D-A loop since it shapes the way we observe, the way we decide, the way we act.

As stated by Boyd and shown in the “Orient” box, there is much filtering of the information through our culture, genetics, ability to analyze and synthesize, and previous experience. Since the OODA Loop was designed to describe a single decision maker, the situation is usually much worse than shown, as most business and technical decisions have a team of people observing and orienting, each bringing their own cultural traditions, genetics, experience and other information. It is here that decisions often get stuck, which does not lead to winning, because:

In order to win, we should operate at a faster tempo or rhythm than our adversaries—or, better yet, get inside [the] adversary's Observation-Orient-Decision-Action time cycle or loop ... Such activity will make us appear ambiguous (unpredictable) thereby generate confusion and disorder among our adversaries—since our adversaries will be unable to generate mental images or pictures that agree with the menacing, as well as faster transient rhythm or patterns, they are competing against.

The OODA loop, which focuses on strategic military requirements, was adapted for business and public sector operational continuity planning. Compare it to the Plan Do Check Act (PDCA) cycle or Shewhart cycle.

As one of Boyd's colleagues, Harry Hillaker, put it in “John Boyd, USAF Retired, Father of the F16”:

The key is to obscure your intentions and make them unpredictable to your opponent while you simultaneously clarify his intentions. That is, operate at a faster tempo to generate rapidly changing conditions that inhibit your opponent from adapting or reacting to those changes and that suppress or destroy his awareness. Thus, a hodgepodge of confusion and disorder occur to cause him to over- or under-react to conditions or activities that appear to be uncertain, ambiguous, or incomprehensible.

The OODA Loop also serves to explain the nature of surprise and shaping operations in a way that unifies Gestalt psychology, cognitive science and game theory in a comprehensive theory of strategy. Utility theory (the basis of game theory) describes how decisions are made based on the perceived value of taking an action. The OODA Loop shows that prior to making a decision (the Decide phase), the person will first have to get information (Observe) and determine what it means to him and what he can do about it (Orient). In this way, the utility sought at the Decide phase can be altered by affecting the information the opponent receives and the cognitive model he applies when orienting upon it.* [5]

Writer Robert Greene wrote in an article called *OODA and You* that

... the proper mindset is to let go a little, to allow some of the chaos to become part of his mental system, and to use it to his advantage by simply creating more chaos and confusion for the opponent. He funnels the inevitable chaos of the battlefield in the direction of the enemy.

41.2 Applicability

Consider a fighter pilot being scrambled to shoot down an enemy aircraft.

Before the enemy airplane is even within visual range, the pilot will consider any available information about the likely identity of the enemy pilot—the nationality, level of training, and cultural traditions that may come into play.

When the enemy aircraft comes into radar contact, more direct information about the speed, size, and maneuverability of the enemy plane becomes available; unfolding circumstances take priority over radio chatter. A first decision is made based on the available information so far: The pilot **decides** to “get into the sun” above his opponent, and **acts** by applying control inputs to climb. Back to **observation**—is the attacker reacting to the change of altitude? Then comes **orient**: Is the enemy reacting characteristically, or perhaps acting like a noncombatant? Is his plane exhibiting better-than-expected performance?

As the dogfight begins, little time is devoted to orienting unless some new information pertaining to the actual identity or intent of the attacker comes into play. Information cascades in real time, and the pilot does not have time to process it consciously; the pilot reacts as he is trained to, and conscious thought is directed to supervising the flow of action and reaction, continuously repeating the OODA cycle. Simultaneously, the opponent is going through the same cycle.

One of John Boyd's primary insights in fighter combat was that it is vital to change speed and direction faster than the opponent. This may interfere with an opponent's OODA cycle. It is not necessarily a function of the plane's ability to maneuver, but the pilot must think and act faster than the opponent can think and act. Getting “inside” the cycle, short-circuiting the opponent's thinking processes, produces opportunities for the opponent to react inappropriately.

Another tactical-level example can be found on the basketball court, where a player takes possession of the ball and must get past an opponent who is taller or faster. A straight dribble or pass is unlikely to succeed. Instead, the player may engage in a rapid and elaborate series of body movements designed to befuddle the opponent and deny him the ability to take advantage of his superior size or speed. At a basic level of play, this may be merely a series of fakes, with the hope that the opponent will make a mistake or an opening will occur, but practice and mental focus may allow one to accelerate tempo, get inside the opponent's OODA loop, and take control of the situation, causing the opponent to move in a particular way and generating an advantage rather than merely reacting to an accident. Taking control of the situation is key. It is not enough to speed through OODA faster, which results in flailing.

The same cycle operates over a longer timescale in a competitive business landscape, and the same logic applies. Decision makers gather information (observe), form hypotheses about customer activity and the intentions of competitors (orient), make decisions, and act on them. The cycle is repeated continuously. The aggressive and conscious application of the process gives a business advantage over a competitor who is merely reacting to conditions as they occur or has poor awareness of the situation. Especially in business, in which teams of people are working the OODA Loop, it often gets stuck at the “D” (see Ullman) and no action is taken allowing the competition to gain the upper hand or resources to be wasted.

The approach favors agility over raw power in dealing with human opponents in any endeavor. Boyd put the ethos into practice with his work for the United States Air Force. He was an advocate of maneuverable fighter aircraft, in contrast to the heavy, powerful jet fighters (such as the McDonnell Douglas F-4 Phantom II) that were prevalent in the 1960s. Boyd inspired the Lightweight Fighter program (LWF) that produced the successful General Dynamics F-16 Fighting Falcon and McDonnell Douglas F/A-18 Hornet, which are still in use by the United States and several other military powers into the 21st century.

41.3 See also

- Control theory
- Decision cycle
- Double-loop learning
- Learning cycle
- Maneuver warfare
- Mental model
- Nursing process
- Problem solving
- Situation awareness
- SWOT analysis

41.4 Notes

[1] See, e.g. Dreier pp. 20–85

[2] See, e.g. Richards pp. 162–171

[3] Papenfuhs, Steve (Pappy). “The OODA loop, reaction time, and decision making” . PoliceOne.com. Retrieved 3 November 2016.

[4] Osinga, Frans. *Science Strategy and War, The Strategic Theory of John Boyd*. Abingdon, UK: Routledge. ISBN 0-415-37103-1.

[5] See, e.g. Dreier pp. 79–85

41.5 References

- Boyd, John R. (3 September 1976). *Destruction and Creation* (PDF). U.S. Army Command and General Staff College.
- Boyd, John, R., *The Essence of Winning and Losing*, 28 June 1995 a five slide set by Boyd.
- Dreier, A.S., *Strategy, Planning & Litigating to Win*, Boston, MA: Conatus Press, ISBN 9780615676951
- Greene, Robert, *OODA and You*
- Hillaker, Harry, *Code one magazine*, “John Boyd, USAF Retired, Father of the F16” , July 1997.
- Kotnour, Jim, “Leadership Mechanisms for Enabling Learning Within Project Teams” in *Proceedings from the Third European Conference on Organizational Knowledge, Learning and Capabilities*, Proceedings OKLC 2002
- Linger, Henry, *Constructing The Infrastructure for the Knowledge Economy: Methods and Tools, Theory and Practice*, p. 449
- Metayer, Estelle, *Decision making: It's all about taking off – and landing safely...*, Competia, December 2011
- Richards, Chet, *Certain to Win: the Strategy of John Boyd, Applied to Business* (2004) ISBN 1-4134-5377-5
- Ullman, David G., “OO-OO-OO!” *The Sound of a Broken OODA Loop*, Crosstalk, April 2007

41.6 External links

- [Archived documents](#)
- Video: The OODA Loop and Clausewitzian “Friction”
- Bazin, A. (2005). Boyd's OODA Loop and the Infantry Company Commander. Infantry Magazine.

Chapter 42

"Ramayana"

This article is about the original Sanskrit version by Valmiki. For other uses, see [Ramayana \(disambiguation\)](#).

The ***Ramayana*** (/rɑːˈmɑːjənə/; ^[1] Sanskrit: रामायणम्, *Rāmāyaṇam*, pronounced [ɾaːˈmaːjəɳəm]) is an ancient Indian epic poem which narrates the struggle of the divine prince Rama to rescue his wife Sita from the demon king Ravana. Along with the *Mahabharata*, it forms the Sanskrit *Itihasa*.

The epic, traditionally ascribed to the Hindu sage Valmiki, narrates the life of Rama, the legendary prince of the Kosala Kingdom. It follows his banishment from the kingdom by his father King Dasharatha, his travels across forests in India with his wife Sita and brother Lakshmana, the kidnapping of his wife by Ravana, the demon king of Lanka, resulting in a war with him, and Rama's eventual return to Ayodhya to be crowned king.

The *Ramayana* is one of the largest ancient epics in world literature. It consists of nearly 24,000 verses (mostly set in the *Shloka* meter), divided into seven Kandas (books) and about 500 sargas (chapters). In Hindu tradition, it is considered to be the *adi-kavya* (first poem). It depicts the duties of relationships, portraying ideal characters like the ideal father, the ideal servant, the ideal brother, the ideal wife and the ideal king. The *Ramayana* was an important influence on later Sanskrit poetry and Hindu life and culture. Like the *Mahabharata*, the *Ramayana* is not just a story: it presents the teachings of ancient Hindu sages in narrative *allegory*, interspersing philosophical and ethical elements. The characters Rama, Sita, Lakshmana, Bharata, Hanuman and Ravana are all fundamental to the cultural consciousness of India, Nepal, Sri Lanka and south-east Asian countries such as Thailand, Cambodia, Malaysia and Indonesia.

There are many versions of the *Ramayana* in Indian languages, besides Buddhist, Sikh and Jain adaptations. There are also Cambodian, Indonesian, Filipino, Thai, Lao, Burmese and Malaysian versions of the tale.

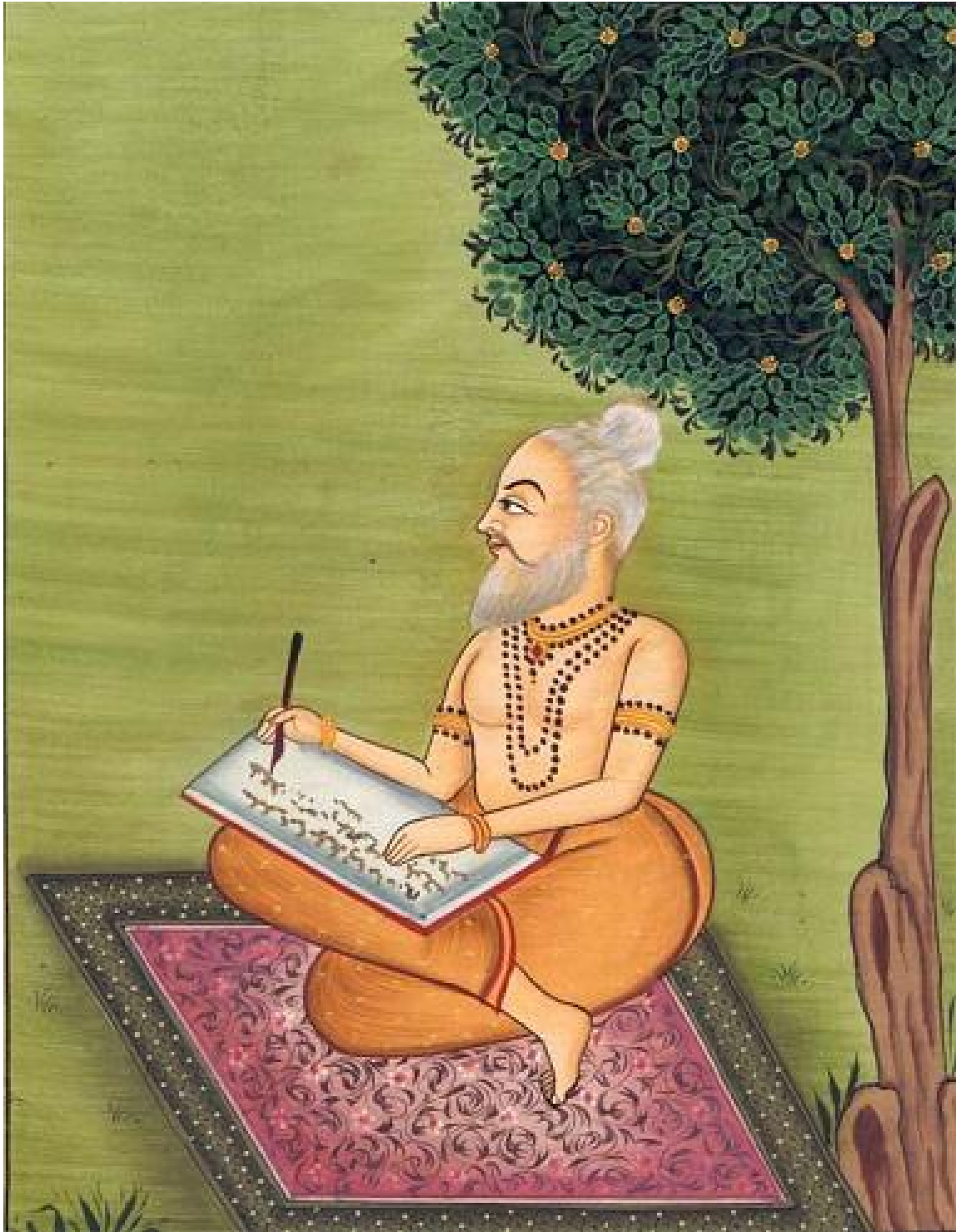
42.1 Etymology

The name *Ramayana* is a *tatpuruṣa* compound of the name *Rāma* and *ayana* (going, advancing), translating to “Rama's journey” .

42.2 Textual history and structure

According to Hindu tradition – and according to the *Ramayana* itself – the epic belongs to the genre of *itihasa* like *Mahabharata*. The definition of *itihāsa* is a narrative of past events (*purāvr̥tta*) which includes teachings on the goals of human life. According to Hindu tradition, *Ramayana* takes place during a period of time known as *Treta Yuga*.

In its extant form, Valmiki's *Ramayana* is an epic poem of some 24,000 verses. The text survives in several thousand partial and complete manuscripts, the oldest of which is a palm-leaf manuscript found in Nepal and dated to the 11th century CE. A Times of India report dated 18 December 2015 informs about the discovery of a 6th-century manuscript of the *Ramayana* at the Asiatic Society library, Kolkata.^[2] The *Ramayana* text has several regional renderings, recensions and subrecensions. Textual scholar Robert P. Goldman differentiates two major regional revisions: the northern (n) and the southern (s). Scholar Romesh Chunder Dutt writes that “the *Ramayana*, like the



An artist's impression of Valmiki Muni composing the Ramyana

Mahabharata, is a growth of centuries, but the main story is more distinctly the creation of one mind.”

There has been discussion as to whether the first and the last chapters of Valmiki's *Ramayana* were composed by the original author. Most Hindus still believe they are integral parts of the book, in spite of some style differences and narrative contradictions between these two chapters and the rest of the book.*[3]

Famous retellings include Gona Budda Reddy's *Ramayanam* in Telugu, Kamban's *Ramavataram* in Tamil (c. 11th–12th century), Madhava Kandali's *Saptakanda Ramayana* in Assamese (c. 14th century), Krittibas Ojha's *Krittivasi Ramayan* (also known as *Shri Rama Panchali*) in Bengali (c. 15th century), Sarala Das' *Vilanka Ramayana* (c. 15th

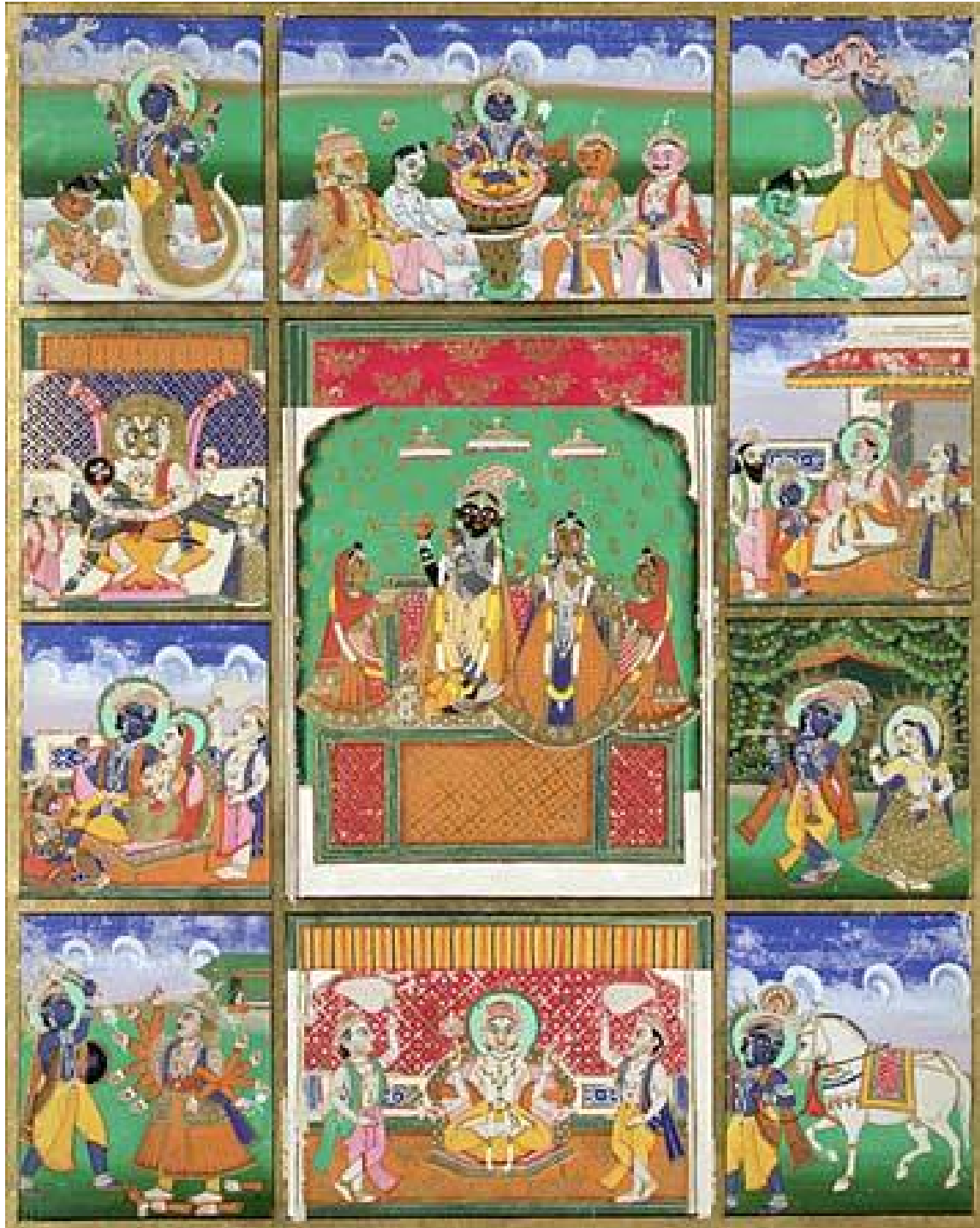


Scene Ramayana, Gupta art, National Museum, New Delhi

century)*[4]*[5]*[6]*[7] and Balaram Das' *Dandi Ramayana* (also known as the *Jagamohan Ramayana*) (c. 16th century) both in Odia, sant Eknath's *Bhavarth Ramayan* (c. 16th century) in Marathi, Tulsidas' *Ramcharitamanas* (c. 16th century) in Awadhi (which is an eastern form of Hindi) and Thunchaththu Ezhuthachan's *Adhyathmaramayanam*

in Malayalam.

42.3 Period



Rama (left third from top) depicted in the Dashavatara, the ten avatars of Vishnu. Painting from Jaipur, now at the Victoria and Albert Museum

Some cultural evidence, such as the presence of sati in Mahabharata but not in the main body of Ramayana, suggests that Ramayana predates Mahabharata. However, the general cultural background of Ramayana is one of the post-urbanization period of the eastern part of north India and Nepal, while Mahabharata reflects the Kuru areas west of this, from the Rigvedic to the late Vedic period.

By tradition, the text belongs to the **Treta Yuga**, second of the four eons (yuga) of Hindu chronology. Rama is said to have been born in the Treta yuga to king **Dasharatha** in the **Ikshvaku** dynasty.

The names of the characters (Rama, Sita, Dasharatha, Janaka, **Vashista**, **Vishwamitra**) are all known in late Vedic literature. However, nowhere in the surviving Vedic poetry is there a story similar to the Ramayana of Valmiki. According to the modern **academic** view, Vishnu, who, according to **bala kanda**, was incarnated as **Rama**, first came into prominence with the epics themselves and further, during the puranic period of the later 1st millennium CE. Also, in the epic Mahabharata, there is a version of Ramayana known as Ramopakhyana. This version is depicted as a narration to **Yudhishtira**.

There is general consensus that books two to six form the oldest portion of the epic, while the first and last books (Bala Kanda and Uttara Kanda, respectively) are later additions. The author or authors of Bala Kanda and Ayodhya Kanda appear to be familiar with the eastern **Gangetic** basin region of northern India and with the **Kosala**, **Mithila** and **Magadha** regions during the period of the sixteen **Mahajanapadas**, based on the fact that the geographical and geopolitical data accords with what is known about the region. The knowledge of the location of the island of Lanka also lacks detail. Basing his assumption on these features, archeologist **Hasmukh Dhirajlal Sankalia** has proposed a date of the 4th century BC for the composition of the text. Historian and Indologist **Arthur Llewellyn Basham** is of the opinion that Rama may have been a minor chief who lived in the 8th or the 7th century BCE.

42.4 Characters



Rama seated with Sita, fanned by Lakshmana, while Hanuman pays his respects.

42.4.1 Ikshvaku dynasty

- **Dasharatha** is king of Ayodhya and father of Rama. He has three queens, Kausalya, Kaikeyi and Sumitra and three other sons: Bharata, Lakshmana and Shatrughna. Kaikeyi, Dasharatha's favourite queen, forces him to make his son Bharata crown prince and send Rama into exile. Dasharatha dies heartbroken after Rama goes into exile.
- **Rama** is the main protagonist or hero of the tale. Portrayed as the seventh avatar of god Vishnu, he is the eldest and favourite son of Dasharatha, the king of Ayodhya and his Chief Queen, Kausalya. He is portrayed

as the epitome of virtue. Dasharatha is forced by **Kaikeyi**, the second of his three wives, to command Rama to relinquish his right to the throne for fourteen years and go into exile. Rama kills the evil demon Ravana, who abducted his wife Sita, and later returns to Ayodhya to form an ideal state.

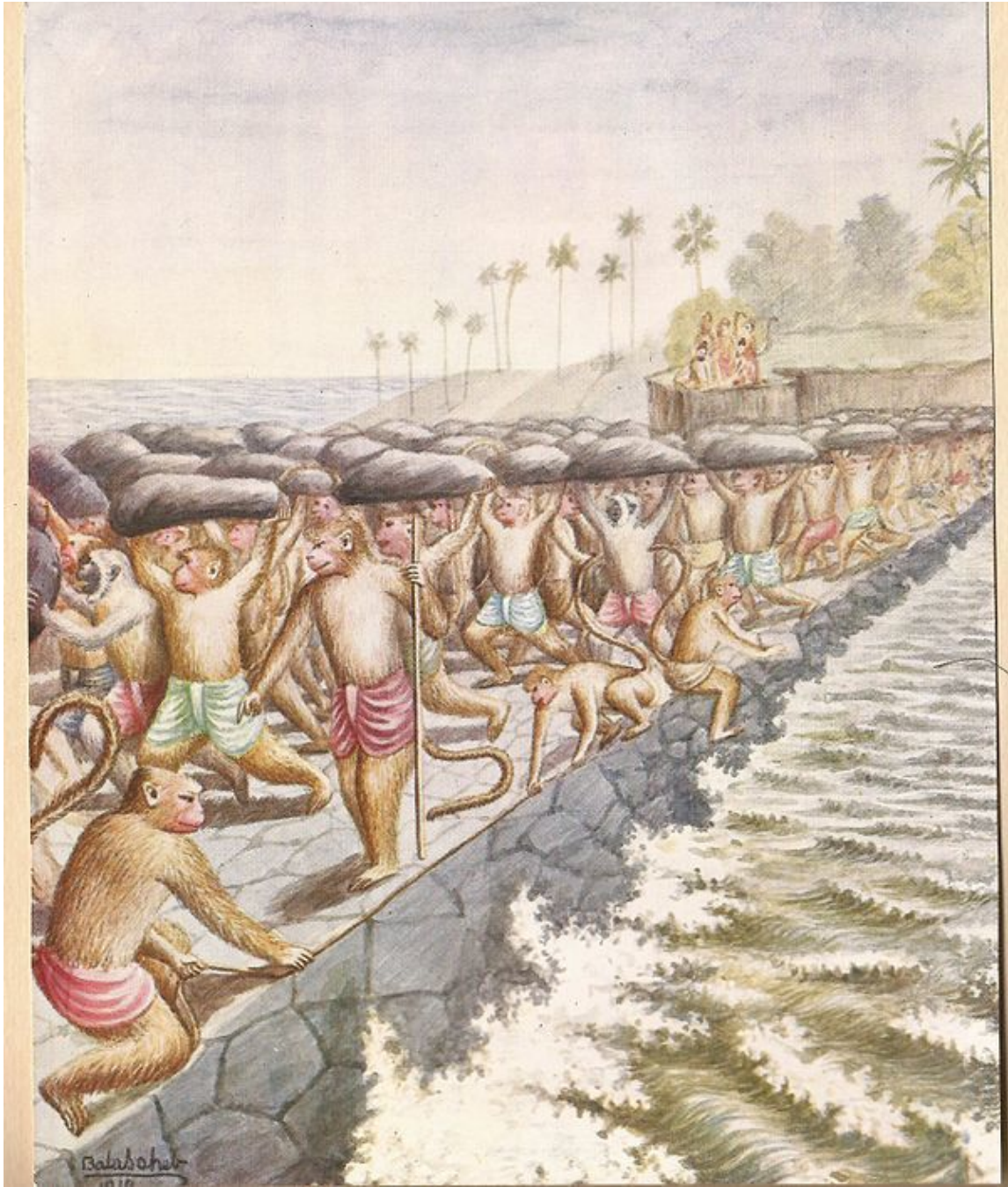


Rama and the monkey chiefs

- **Sita** is another of the tale's protagonists. She is a daughter of Mother Earth, adopted by King Janaka, and Rama's beloved wife. Rama went to **Mithila** and got a chance to marry her by breaking the Shiv Dhanush (bow) while trying to tie a knot to it in a competition organized by King Janaka of **Mithila** in **Dhanusa**. The competition was to find the most suitable husband for Sita and many princes from different states competed to win her. Sita is the avatara of goddess **Lakshmi**, the consort of Vishnu. Sita is portrayed as the epitome of female purity and virtue. She follows her husband into exile and is abducted by the demon king Ravana. She is imprisoned on the island of **Lanka**, until Rama rescues her by defeating Ravana. Later, she gives birth to **Luv** and **Kusha**.
- **Bharata** is the son of Dasharatha and Queen Kaikeyi. When he learns that his mother Kaikeyi has forced Rama into exile and caused Dasharatha to die brokenhearted, he storms out of the palace and goes in search of Rama in the forest. When Rama refuses to return from his exile to assume the throne, Bharata obtains Rama's sandals and places them on the throne as a gesture that Rama is the true king. Bharata then rules Ayodhya as the regent of Rama for the next fourteen years, staying outside the city of Ayodhya. He was married to Mandavi.
- **Lakshmana** is a younger brother of Rama, who chose to go into exile with him. He is the son of King Dasharatha and Queen Sumitra and twin of Shatrughna. Lakshmana is portrayed as an avatar of **Shesha**, the **nāga** associated with the god Vishnu. He spends his time protecting Sita and Rama, during which time he fights the demoness **Surpanakha**. He is forced to leave Sita, who was deceived by the demon **Maricha** into believing that Rama was in trouble. Sita is abducted by Ravana upon his leaving her. He was married to Sita's younger sister **Urmila**.
- **Shatrughna** is a son of Dasharatha and his second wife Queen Sumitra. He is the youngest brother of Rama and also the twin brother of Lakshmana. He was married to Shrutakirti.

42.4.2 Allies of Rama

Vanara



Building a Rama Setu Bridge to Lanka.

- **Hanuman** is a **vanara** belonging to the kingdom of Kishkindha. He is an ideal **bhakta** of Rama. He is born as son of Kesari, a Vanara king in Sumeru region and the goddess **Añjanā**. He plays an important part in locating Sita and in the ensuing battle. He is believed to live until our modern world.
- **Sugriva**, a vanara king who helped Rama regain Sita from Ravana. He had an agreement with Rama through which Vali – Sugriva's brother and king of Kishkindha – would be killed by Rama in exchange for Sugriva's help in finding Sita. Sugriva ultimately ascends the throne of Kishkindha after the slaying of Vali and fulfills his promise by putting the Vanara forces at Rama's disposal.
- **Angada** is a vanara who helped Rama find his wife Sita and fight her abductor, **Ravana**, in Ramayana. He was son of Vali and Tara and nephew of **Sugriva**. Angada and Tara are instrumental in reconciling **Rama** and his brother, **Lakshmana**, with **Sugriva** after Sugriva fails to fulfill his promise to help Rama find and rescue his wife. Together they are able to convince Sugriva to honor his pledge to Rama instead of spending his time

carousing and drinking.

Riksha

- **Jambavan/Jamvanta** is known as Riksharaj (King of the Rikshas). Rikshas are bears. In the epic Ramayana, Jambavantha helped Rama find his wife Sita and fight her abductor, Ravana. It is he who makes Hanuman realize his immense capabilities and encourages him to fly across the ocean to search for Sita in Lanka.

Griddha

- **Jatayu**, son of **Aruṇa** and nephew of **Garuda**. A demi-god who has the form of a vulture that tries to rescue Sita from Ravana. Jatayu fought valiantly with Ravana, but as Jatayu was very old, Ravana soon got the better of him. As Rama and Lakshmana chanced upon the stricken and dying Jatayu in their search for Sita, he informs them of the direction in which Ravana had gone.
- **Sampati**, son of **Aruna**, brother of **Jatayu**. Sampati's role proved to be instrumental in the search for Sita.

Rakshasa

- **Vibhishana**, youngest brother of Ravana. He was against the kidnapping of Sita and joined the forces of Rama when Ravana refused to return her. His intricate knowledge of Lanka was vital in the war and he was crowned king after the fall of Ravana.

42.4.3 Foes of Rama

Rakshasas

- **Ravana**, a rakshasa, is the king of Lanka. He was son of a sage named **Vishrava** and daitya princess **Kaikesi**. After performing severe penance for ten thousand years he received a boon from the creator-god **Brahma**: he could henceforth not be killed by gods, demons, or spirits. He is portrayed as a powerful demon king who disturbs the penances of **rishis**. Vishnu incarnates as the human Rama to defeat him, thus circumventing the boon given by Brahma.
- **Indrajit** or **Meghnadha**, the eldest son of Ravana who twice defeated Rama and Lakshmana in battle, before succumbing to Lakshmana. An adept of the magical arts, he coupled his supreme fighting skills with various stratagems to inflict heavy losses on Vanara army before his death.
- **Kumbhakarna**, brother of Ravana, famous for his eating and sleeping. He would sleep for months at a time and would be extremely ravenous upon waking up, consuming anything set before him. His monstrous size and loyalty made him an important part of Ravana's army. During the war he decimated the Vanara army before Rama cut off his limbs and head.
- **Surpanakha**, Ravana's demoness sister who fell in love with Rama and had the magical power to take any form she wanted.

Vanara

- **Vali**, was king of **Kishkindha**, husband of Tara, a son of **Indra**, elder brother of **Sugriva** and father of **Angada**. Vali was famous for the boon that he had received, according to which anyone who fought him in single-combat lost half his strength to Vali, thereby making Vali invulnerable to any enemy. He was killed by Lord Rama, an Avatar of Vishnu.

42.5 Synopsis



Pictorial depiction of the birth of four sons of Dasharatha

42.5.1 *Bala Kanda*

Main article: *Bala Kanda*

Dasharatha was the king of Ayodhya. He had three wives: Kaushalya, Kaikeyi and Sumitra. He was childless for a long time and anxious to produce an heir, so he performs a fire sacrifice known as *putra-kameshti yagya*. As a consequence, Rama is first born to Kaushalya, Bharata is born to Kaikeyi, Lakshmana and Shatrughna are born to Sumitra. These sons are endowed, to various degrees, with the essence of the Supreme Trinity Entity Vishnu; Vishnu had opted to be born into mortality to combat the demon Ravana, who was oppressing the gods, and who could only be destroyed by a mortal. The boys are reared as the princes of the realm, receiving instructions from the scriptures and in warfare from Vashistha. When Rama is 16 years old, sage Vishwamitra comes to the court of Dasharatha in search of help against demons who were disturbing sacrificial rites. He chooses Rama, who is followed by Lakshmana, his constant companion throughout the story. Rama and Lakshmana receive instructions and supernatural weapons from Vishwamitra and proceed to destroy the demons.

Janaka was the king of Mithila. One day, a female child was found in the field by the king in the deep furrow dug by his plough. Overwhelmed with joy, the king regarded the child as a “miraculous gift of god”. The child was named Sita, the Sanskrit word for furrow. Sita grew up to be a girl of unparalleled beauty and charm. The king had decided that who ever could lift and wield the heavy bow, presented to his ancestors by Shiva, could marry Sita. Sage Vishwamitra takes Rama and Lakshmana to Mithila to show the bow. Then Rama desires to lift it and goes on to wield the bow and when he draws the string, it breaks.*[8] Marriages are arranged between the sons of Dasharatha and daughters of Janaka. Rama gets married to Sita, Lakshmana to Urmila, Bharata to Mandavi and Shatrughna to Shrutakirti. The weddings are celebrated with great festivity at Mithila and the marriage party returns to Ayodhya.

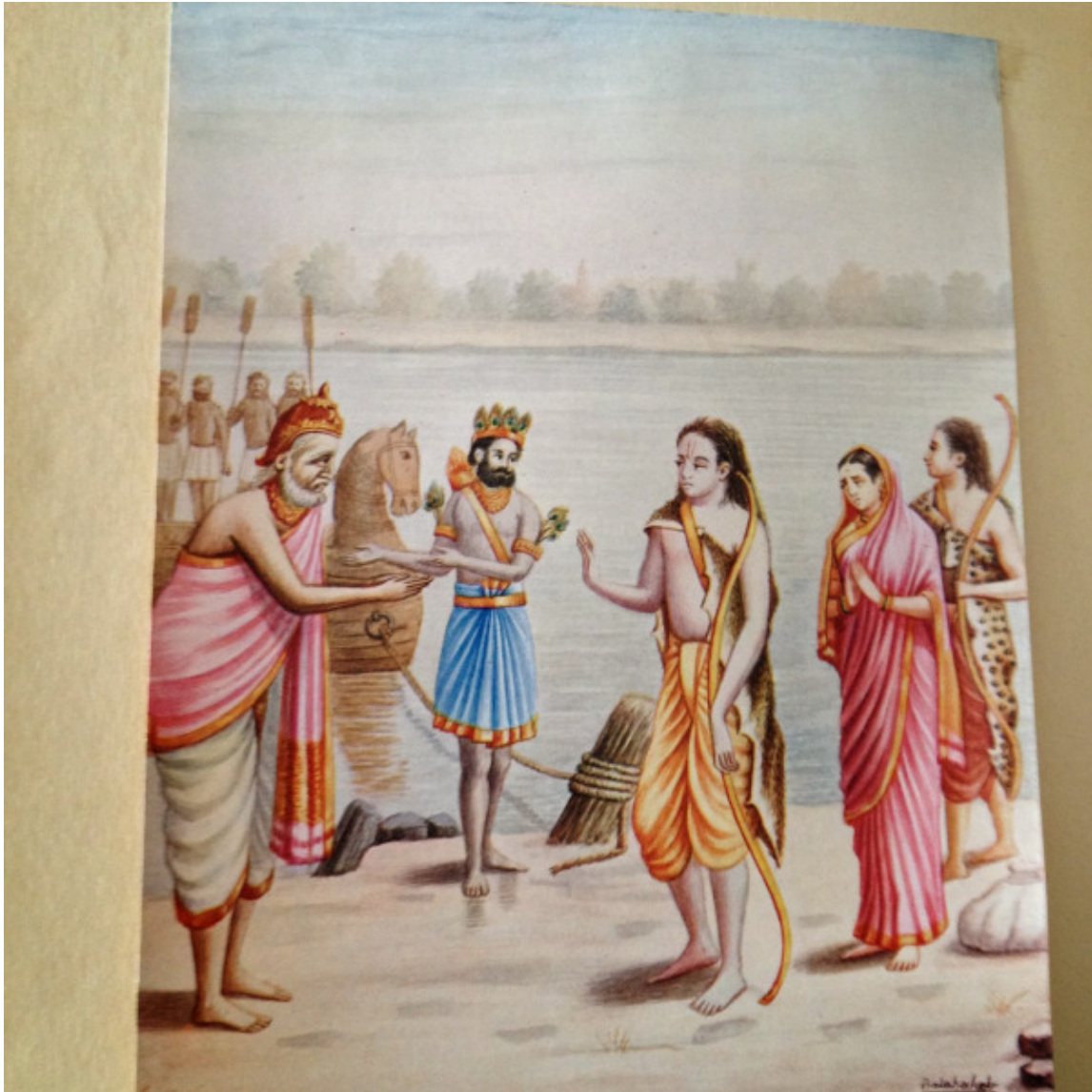
42.5.2 *Ayodhya Kanda*

After Rama and Sita have been married for twelve years, an elderly Dasharatha expresses his desire to crown Rama, to which the Kosala assembly and his subjects express their support. On the eve of the great event, Kaikeyi – her jealousy aroused by Manthara, a wicked maidservant – claims two boons that Dasharatha had long ago granted her. Kaikeyi demands Rama to be exiled into the wilderness for fourteen years, while the succession passes to her son Bharata. The heartbroken king, constrained by his rigid devotion to his given word, accedes to Kaikeyi's demands. Rama accepts his father's reluctant decree with absolute submission and calm self-control which characterises him throughout the story. He is joined by Sita and Lakshmana. When he asks Sita not to follow him, she says, “the forest where you dwell is Ayodhya for me and Ayodhya without you is a veritable hell for me.” After Rama's departure,



Vishvamitra looks on as Rama breaks the bow, to win the hand of Sita in marriage.

King Dasharatha, unable to bear the grief, passes away. Meanwhile, Bharata who was on a visit to his maternal uncle, learns about the events in Ayodhya. Bharata refuses to profit from his mother's wicked scheming and visits Rama in the forest. He requests Rama to return and rule. But Rama, determined to carry out his father's orders to the letter, refuses to return before the period of exile. However, Bharata carries Rama's sandals and keeps them on the throne, while he rules as Rama's regent.



Guha, King of the hunter tribe (Nishadas) helped Rama and his companions cross the river

42.5.3 Aranya Kanda

Main article: **Aranya Kanda**

Thirteen years pass and in the last year of exile Rama, Sita and Lakshmana journey southward along the banks of river **Godavari**, where they build cottages and live off the land. At the **Panchavati** forest they are visited by a **rakshasa** (demon) woman, **Surpanakha**, sister of Ravana. She attempts to seduce the brothers and failing in this, attempts to kill Sita. Lakshmana stops her by cutting off her nose and ears. Hearing of this, her demon brother, **Khara**, organises an attack against the princes. Rama annihilates Khara and his demons.

When news of these events reaches Ravana, he resolves to destroy Rama by capturing Sita with the aid of the **rakshasa Maricha**. Maricha, assuming the form of a golden deer, captivates Sita's attention. Entranced by the beauty of the deer, Sita pleads with Rama to capture it. Lord Rama, aware that this is the ploy of the demons, cannot dissuade Sita from her desire and chases the deer into the forest, leaving Sita under Lakshmana's guard. After some time, Sita hears Rama calling out to her; afraid for his life, she insists that Lakshmana rush to his aid. Lakshmana tries to assure her that Rama is invincible and that it is best if he continues to follow Rama's orders to protect her. On the verge of hysterics, Sita insists that it is not she but Rama who needs Lakshmana's help. He obeys her wish but stipulates that she is not to leave the cottage or entertain any strangers. He draws a chalk outline, the **Lakshmana rekha**, around the cottage and casts a spell on it that prevents anyone from entering the boundary but allows people to exit. With the coast finally clear, Ravana appears in the guise of an ascetic requesting Sita's hospitality. Unaware of the devious



Ravana fights Jatayu as he carries off the kidnapped Sita. Painting by Raja Ravi Varma

plan of her guest, Sita is tricked into leaving the rekha and is then forcibly carried away by the evil Ravana.*[9]

Jatayu, a vulture, tries to rescue Sita, but is mortally wounded. At Lanka, Sita is kept under the heavy guard of *rakshasis*. Ravana demands Sita marry him, but Sita, eternally devoted to Rama, refuses. Rama and Lakshmana

learn about Sita's abduction from Jatayu and immediately set out to save her. During their search, they meet the demon **Kabandha** and the ascetic **Shabari**, who direct them towards Sugriva and Hanuman.

42.5.4 *Kishkindha Kanda*

Main article: **Kishkindha Kanda**

Kishkindha Kanda is set in the ape (*Vanara*) citadel **Kishkindha**. Rama and Lakshmana meet Hanuman, the



A stone bas-relief at Banteay Srei in Cambodia depicts the combat between Vali and Sugriva (middle). To the right, Rama fires his bow. To the left, Vali lies dying.

biggest devotee of Rama, greatest of ape heroes and an adherent of Sugriva, the banished pretender to the throne of Kishkindha. Rama befriends Sugriva and helps him by killing his elder brother **Vali** thus regaining the kingdom of Kishkindha, in exchange for helping Rama to recover Sita. However Sugriva soon forgets his promise and spends his time in enjoying his powers. The clever former ape queen Tara (wife of Vali) calmly intervenes to prevent an enraged Lakshmana from destroying the ape citadel. She then eloquently convinces Sugriva to honour his pledge. Sugriva then sends search parties to the four corners of the earth, only to return without success from north, east and west. The southern search party under the leadership of **Angada** and Hanuman learns from a vulture named **Sampati** (elder brother of Jatayu), that Sita was taken to Lanka.

42.5.5 *Sundara Kanda*

Main article: **Sundara Kanda**

Sundara Kanda forms the heart of Valmiki's Ramayana and consists of a detailed, vivid account of **Hanuman's** adventures. After learning about Sita, Hanuman **assumes** a gargantuan form and makes a colossal leap across the sea to Lanka. On the way he meets with many challenges like facing a Gandharva kanya who comes in the form of a demon to test his abilities. He encounters a mountain named Mainakudu who offers Lord Hanuman assistance and offers him rest. Lord Hanuman refuses because there is little time remaining to complete the search for Sita.



Ravana is meeting Sita at Ashokavana. Hanuman is seen on the tree.

After entering into Lanka, he finds a demon, Lankini, who protects all of Lanka. Hanuman fights with her and subjugates her in order to get into Lanka. In the process Lankini, who had a earlier vision/warning from the gods that the end of Lanka nears if someone defeats Lankini. Here, Hanuman explores the demons' kingdom and spies on Ravana. He locates Sita in Ashoka grove, where she is being wooed and threatened by Ravana and his rakshasis to marry Ravana. Hanuman reassures Sita, giving Rama's signet ring as a sign of good faith. He offers to carry Sita back to Rama; however, she refuses and says that it is not the dharma, stating that Ramayana will not have significance if Hanuman carries her to Rama - "When Rama is not there Ravana carried Sita forcibly and when Ravana was not there, Hanuman carried Sita back to Rama". She says that Rama himself must come and avenge the insult of her abduction.

Hanuman then wreaks havoc in Lanka by destroying trees and buildings and killing Ravana's warriors. He allows himself to be captured and delivered to Ravana. He gives a bold lecture to Ravana to release Sita. He is condemned and his tail is set on fire, but he escapes his bonds and leaping from roof to roof, sets fire to Ravana's citadel and makes the giant leap back from the island. The joyous search party returns to Kishkindha with the news.

42.5.6 *Yuddha Kanda*

Main article: [Yuddha Kanda](#)

Also known as *Lanka Kanda*, this book describes the [Ramayana War](#) between the army of Rama and the army of Ravana. Having received Hanuman's report on Sita, Rama and Lakshmana proceed with their allies towards the shore of the southern sea. There they are joined by Ravana's renegade brother [Vibhishana](#). The apes named [Nala](#) and [Nila](#) construct a floating bridge (known as [Rama Setu](#))^[10] across the sea, using stones that floated on water because they had Rama's name written on them. The princes and their army cross over to Lanka. A lengthy war ensues. During a battle, Ravana's son [Indrajit](#) hurls a powerful weapon at Lakshmana, who is badly wounded and is nearly killed. So Hanuman assumes a gigantic form and flies from Lanka to the Himalayas. Upon reaching Mount Sumeru, Hanuman was unable to identify the herb that could cure Lakshmana and so decided to bring the entire mountain back to Lanka. Eventually, the war ends when Rama kills Ravana. Rama then installs Vibhishana on the throne of Lanka.

On meeting Sita, Rama asks her to undergo an Agni Pariksha (test of fire) to prove her chastity, as he wants to get rid of the rumors surrounding her purity. When Sita plunges into the sacrificial fire, [Agni](#), lord of fire raises Sita, unharmed, to the throne, attesting to her innocence. The episode of *Agni Pariksha* varies in the versions of Ramayana by Valmiki and Tulsidas. In earlier versions, this event does not occur and many scholars consider it to have been added later as society became more patriarchal. In Tulsidas's *Ramacharitamanas*, Sita was under the protection of



The Battle at Lanka, Ramayana by Sahibdin. It depicts the monkey army of the protagonist Rama (top left, blue figure) fighting Ravana—the demon-king of the Lanka—to save Rama's kidnapped wife, Sita. The painting depicts multiple events in the battle against the three-headed demon general Trisiras, in bottom left. Trisiras is beheaded by Hanuman, the monkey-companion of Rama.

Agni (see [Maya Sita](#)) so it was necessary to bring her out before reuniting with Rama. At the expiration of his term of exile, Rama returns to Ayodhya with Sita and Lakshmana, where the coronation is performed. This is the beginning of Ram Rajya, which implies an ideal state with good morals.

42.5.7 Uttara Kanda

Main article: [Uttara Kanda](#)

Uttara Kanda is regarded to be a later addition to the original story by Valmiki and concerns the final years of Rama, Sita and Rama's brothers. After being crowned king, Rama passes time pleasantly with Sita. After some time, Sita gets pregnant with twin children. However, despite *Agni Pariksha* (“fire ordeal”) of Sita, rumours about her “purity” are spreading among the populace of Ayodhya. Rama yields to public opinion and reluctantly banishes Sita to the forest, where the sage Valmiki provides shelter in his *ashrama* (“hermitage”). Here, she gives birth to twin boys, [Lava](#) and [Kusha](#), who become pupils of Valmiki and are brought up in ignorance of their identity.

Valmiki composes the *Ramayana* and teaches Lava and Kusha to sing it. Later, Rama holds a ceremony during the *Ashwamedha yagna*, which sage Valmiki, with Lava and Kusha, attends. Lava and Kusha sing the *Ramayana* in the presence of Rama and his vast audience. When Lava and Kusha recite about Sita's exile, Rama becomes grief-stricken and Valmiki produces Sita. Sita calls upon the Earth, her mother, to receive her and as the ground opens, she vanishes into it. Rama then learns that Lava and Kusha are his children. Many years later, a messenger from the Gods appears and informs Rama that the mission of his incarnation is over. Rama returns to his celestial abode along with his brothers. It was dramatised as *Uttararamacarita* by the Sanskrit poet Bhavabhuti.

42.6 Versions

See also: [Versions of Ramayana](#)

As in many oral epics, multiple versions of the *Ramayana* survive. In particular, the *Ramayana* related in north India differs in important respects from that preserved in south India and the rest of southeast Asia. There is an extensive tradition of oral storytelling based on *Ramayana* in Indonesia, Cambodia, Philippines, Thailand, Malaysia, Laos, Vietnam and Maldives. Father Kamil Bulke, author of *Ramakatha*, has identified over 300 variants of the



Sita in the hermitage of Valmiki.

Ramayana.

42.6.1 In India

The 7th century CE poem *Bhaṭṭikāvya* of Bhaṭṭi is a Sanskrit retelling of the epic that simultaneously illustrates the grammatical examples for Pāṇini's *Aṣṭādhyāyī* as well as the major figures of speech and the Prakrit language.

There are diverse regional versions of the *Ramayana* written by various authors in India. Some of them differ significantly from each other. During the 12th century, Kamban wrote *Ramavataram*, known popularly as *Kambaramayanam* in Tamil. A Telugu version, *Ranganatha Ramayanam*, was written by Gona Budda Reddy in the 14th century. The earliest translation to a regional Indo-Aryan language is the early 14th century *Saptakanda Ramayana* in Assamese by Madhava Kandali. Valmiki's *Ramayana* inspired *Sri Ramacharit Manas* by Tulsidas in 1576, an epic Awadhi (a dialect of Hindi) version with a slant more grounded in a different realm of Hindu literature, that of *bhakti*; it is an acknowledged masterpiece of India, popularly known as *Tulsi-krita Ramayana*. Gujarati poet Premanand wrote a version of the *Ramayana* in the 17th century. Other versions include *Krittivasi Ramayan*, a Bengali version by Krittibas Ojha in the 15th century; *Vilanka Ramayana* by 15th century poet Sarala Dasa* [11] and *Dandi Ramayana* (also known as *Jagamohana Ramayana*) by 16th century poet Balarama Dasa, both in Odia; a *Torave Ramayana* in Kannada by 16th-century poet Narahari; *Adhyathmaramayanam*, a Malayalam version by Thunchaththu Ramanujan Ezhuthachan in the 16th century; in Marathi by Sridhara in the 18th century; in Maithili by Chanda Jha in the 19th century; and in the 20th century, Rashtrakavi Kuvempu's *Sri Ramayana Darshanam* in Kannada.

There is a sub-plot to the *Ramayana*, prevalent in some parts of India, relating the adventures of Ahiravan and Mahi Ravana, evil brother of Ravana, which enhances the role of Hanuman in the story. Hanuman rescues Rama and Lakshmana after they are kidnapped by the Ahi-Mahi Ravana at the behest of Ravana and held prisoner in a subterranean cave, to be sacrificed to the goddess Kali. *Adbhuta Ramayana* is a version that is obscure but also attributed to Valmiki – intended as a supplementary to the original Valmiki *Ramayana*. In this variant of the narrative,



The epic story of Ramayana was adopted by several cultures across Asia. Shown here is a Thai historic artwork depicting the battle which took place between Rama and Ravana.

Sita is accorded far more prominence, such as elaboration of the events surrounding her birth – in this case to Ravana's wife, Mandodari as well as her conquest of Ravana's older brother in her Mahakali form.

Mappilapattu – a genre of song popular among the Muslims belonging to Kerala and Lakshadweep – has incorporated some episodes from the Ramayana into its songs. These songs, known as mappila ramayana, have been handed down from one generation to the next orally. In mappila ramayana, the story of Ramayana has been changed into that of a sultan and there are no major changes in the names of characters except for that of Rama which is Laman in many places. The language and the imagery projected in the Mappilapattu are in accordance with the social fabric of the earlier Muslim community.

Buddhist Version

In the Buddhist variant of the Ramayana (*Dasarathajātaka*, #467), Dasharatha was king of Benares and not Ayodhya. Rama (called Rāmapaṇḍita in this version) was the son of Kaushalya, first wife of Dasharatha. Lakṣmaṇa (Lakkhaṇa) was a sibling of Rama and son of Sumitra, the second wife of Dasharatha. Sita was the wife of Rama. To protect his children from his wife Kaikeyi, who wished to promote her son Bharata, Dasharatha sent the three to a hermitage in the Himalayas for a twelve-year exile. After nine years, Dasharatha died and Lakkhaṇa and Sita returned; Rāmapaṇḍita, in deference to his father's wishes, remained in exile for a further two years. This version does not include the abduction of Sītā. There is no Ravan in this version i.e. no Ram-ravan war.

In the explanatory commentary on Jātaka, Rāmapaṇḍita is said to have been a previous incarnation of Buddha, and Sita an incarnation of Yasodharā.

But, Ravana appears in other Buddhist literature, Lankavatar Sutta.

Jain Version

Main articles: Rama in Jainism and Salakapurusa



Relief with part of the Ramayana epic. Candi Penataran, Blitar Regency, Java.

Jain versions of the *Ramayana* can be found in the various Jain agamas like Ravisena's *Padmapurana* (story of Padmaja and Rama, Padmaja being the name of Sita), Hemacandra's *Trisastisalakapurusa charitra* (hagiography of 63 illustrious persons), Sanghadasa's *Vasudevahindi* and *Uttarapurana* by Gunabhadara. According to Jain cosmology, every half time cycle has nine sets of Balarama, Vasudeva and prativasudeva. Rama, Lakshmana and Ravana are the eighth baladeva, vasudeva and prativasudeva respectively. Padmanabh Jaini notes that, unlike in the Hindu puranas, the names Baladeva and Vasudeva are not restricted to Balarama and Krishna in Jain Puranas. Instead they serve as names of two distinct classes of mighty brothers, who appear nine times in each half time cycle and jointly rule half the earth as half-chakravartins. Jaini traces the origin of this list of brothers to the *jinacharitra* (lives of jinas) by Acharya Bhadrabahu (3d–4th century BCE).

In the Jain epic of *Ramayana*, it is Lakshmana who ultimately kills Ravana and not Rama as told in the Hindu version. In the end, Rama, who led an upright life, renounces his kingdom, becomes a Jain monk and attains moksha. On the other hand, Lakshmana and Ravana go to Hell. However, it is predicted that ultimately they both will be reborn as upright persons and attain liberation in their future births. According to Jain texts, Ravana will be the future Tirthankara (omniscient teacher) of Jainism.

The Jain versions have some variations from Valmiki's *Ramayana*. Dasharatha, the king of Saketa had four queens: Aparajita, Sumitra, Suprabha and Kaikeyi. These four queens had four sons. Aparajita's son was Padma and he became known by the name of Rama. Sumitra's son was Narayana: he came to be known by another name, Lakshmana. Kaikeyi's son was Bharata and Suprabha's son was Shatrughna. Furthermore, not much was thought of Rama's fidelity to Sita. According to the Jain version, Rama had four chief queens: Maithili, Prabhavati, Ratimbha, and Sridama. Furthermore, Sita takes renunciation as a Jain ascetic after Rama abandons her and is reborn in heaven. Rama, after Lakshmana's death, also renounces his kingdom and becomes a Jain monk. Ultimately, he attains Kevala Jnana omniscience and finally liberation. Rama predicts that Ravana and Lakshmana, who were in the fourth hell, will attain liberation in their future births. Accordingly, Ravana is the future tirthankara of the next half ascending time cycle and Sita will be his Ganadhara.

Sikh Version

In **Guru Granth Sahib**, there is a description of two types of *Ramayana*. One is a spiritual *Ramayana* which is the actual subject of **Guru Granth Sahib**, in which Ravana is ego, Sita is *budhi* (intellect), Rama is inner soul and Laxman is *mann* (attention, mind). **Guru Granth Sahib** also believes in the existence of **Dashavatara** who were kings of their times which tried their best to restore order to the world. King Rama (Ramchandra) was one of those who is not covered in **Guru Granth Sahib**. **Guru Granth Sahib** states:

ਗੁਰਮੁਖਿਯਾਏ ਦਸ ਅਵਤਾਰਾ ॥

ਹੁਕਮੁਤਿਪਾਏ ਦਸ ਅਤਾਰਾ ॥

By **hukam** (supreme command), he created his ten incarnations

This version of the *Ramayana* was written by **Guru Gobind Singh**, which is part of **Dasam Granth**.

He also said that the almighty, invisible, all prevailing God created great numbers of Indras, Moons and Suns, Deities, Demons and sages, and also numerous saints and Brahmanas (enlightened people). But they too were caught in the noose of death (Kaal) (transmigration of the soul). This is similar to the explanation in **Bhagavad Gita** which is part of the *Mahabharata*.

42.6.2 In Nepal

Besides being the site of discovery of the oldest surviving manuscript of the *Ramayana*, Nepal gave rise to two regional variants in mid 19th – early 20th century. One, written by **Bhanubhakta Acharya**, is considered the first epic of **Nepali language**, while the other, written by **Siddhidas Mahaju** in **Nepal Bhasa** was a foundational influence in the **Nepal Bhasa renaissance**.

Ramayana written by **Bhanubhakta Acharya** is one of the most popular verses in Nepal. The popularization of the *Ramayana* and its tale, originally written in **Sanskrit Language** was greatly enhanced by the work of **Bhanubhakta**. Mainly because of his writing of **Nepali Ramayana**, **Bhanubhakta** is also called *Aadi Kavi* or *The Pioneering Poet*.

42.6.3 Southeast Asian

In Cambodia

The Cambodian version of the *Ramayana*, **Reamker**, is the most famous story of **Khmer literature** since the **Kingdom of Funan** era. It adapts the Hindu concepts to Buddhist themes and shows the balance of good and evil in the world. The **Reamker** has several differences from the original *Ramayana*, including scenes not included in the original and emphasis on **Hanuman** and **Sovanna Maccha**, a retelling which influences the Thai and Lao versions. **Reamker** in Cambodia is not confined to the realm of literature but extends to all Cambodian art forms, such as sculpture, **Khmer classical dance**, theatre known as *lakhorn luang* (the foundation of the royal ballet), poetry and the mural and bas-reliefs seen at the **Silver Pagoda** and **Angkor Wat**.

In Laos

Phra Lak Phra Lam is a **Lao language** version, whose title comes from **Lakshmana** and **Rama**. The story of **Lakshmana** and **Rama** is told as the previous life of **Gautama buddha**.

In Malaysia

In **Hikayat Seri Rama of Malaysia**,* [12]* [13] **Dasharatha** is the great-grandson of the Prophet **Adam**. **Ravana** receives boons from **Allah** instead of **Brahma**. In many **Malay language** versions, **Lakshmana** is given greater importance than **Rama**, whose character is considered somewhat weak.



Hanuman discovers Sita in her captivity in Lanka, as depicted in Balinese dance.

In Thailand

Thailand's popular national epic **Ramakien** (Thai:รามเกียรติ์, from Sanskrit *rāmakīrti*, *glory of Rama*) is derived from the Hindu epic. In Ramakien, Sita is the daughter of Ravana and Mandodari (*thotsakan* and *montho*). Vibhishana (*phiphek*), the astrologer brother of Ravana, predicts calamity from the horoscope of Sita. Ravana has thrown her into the water, but she is later rescued by Janaka (*chanok*). While the main story is identical to that of *Ramayana*, many other aspects were transposed into a Thai context, such as the clothes, weapons, topography and elements of nature, which are described as being Thai in style. It has an expanded role for Hanuman and he is portrayed as a lascivious character. Ramakien can be seen in an elaborate illustration at **Wat Phra Kaew** in Bangkok.

In other versions

Other Southeast Asian adaptations include *Kakawin Ramayana* of Java, *Ramakavaca* of Bali (Indonesia), *Maharadia Lawana* and *Darangen* of Moro Muslims of Mindanao (Philippines) and *Yama Zatdaw* of Myanmar.

42.6.4 Critical edition

A critical edition of the text was compiled in India in the 1960s and 1970s, by the Oriental Institute at Maharaja Sayajirao University of Baroda, India, utilizing dozens of manuscripts collected from across India and the surrounding region.*[14] An English language translation of the critical edition was completed in November 2016 by Sanskrit scholar Robert P. Goldman of the University of California, Berkeley.*[15]



Lakshmana, Rama and Sita during their exile in Dandaka Forest depicted in Javanese dance.

42.7 Influence on culture and art

One of the most important literary works of ancient India, the *Ramayana* has had a profound impact on art and culture in the Indian subcontinent and southeast Asia with the lone exception of Vietnam. The story ushered in the tradition of the next thousand years of massive-scale works in the rich diction of regal courts and Hindu temples. It has also inspired much secondary literature in various languages, notably *Kambaramayanam* by Tamil poet Kambar of the 12th century, Telugu language *Molla Ramayanam* by poet Molla and *Ranganatha Ramayanam* by poet Gona Budda Reddy, 14th century Kannada poet Narahari's *Torave Ramayana* and 15th century Bengali poet Krittibas Ojha's *Krittivasi Ramayan*, as well as the 16th century Awadhi version, *Ramacharitamanas*, written by Tulsidas.

The *Ramayana* became popular in southeast Asia during 8th century and was represented in literature, temple archi-



The Thai retelling of the tale—Ramakien—is popularly expressed in traditional regional dance theatre.

ecture, dance and theatre. Today, dramatic enactments of the story of the *Ramayana*, known as *Ramlila*, take place all across India and in many places across the globe within the Indian diaspora.

Ramayana has also been depicted in many paintings, most notably by the Malaysian artist Syed Thajudeen in 1972. The epic tale was picturized on canvas in epic proportions measuring 72 x 453 cm in 9 panels. The painting depicts three prolific parts of the epic, namely The Abduction of Sita, Hanuman visits Sita and Hanuman Burns Lanka. The painting is currently in the permanent collection of the Malaysian National Visual Arts Gallery.

42.8 Religious significance

Rama, the hero of the *Ramayana*, is one of the most popular deities worshipped in the Hindu religion. Each year, many devout pilgrims trace their journey through India and Nepal, halting at each of the holy sites along the way. The poem is not seen as just a literary monument, but serves as an integral part of Hinduism and is held in such reverence that the mere reading or hearing of it or certain passages of it, is believed by Hindus to free them from sin and bless the reader or listener.

According to Hindu tradition, Rama is an incarnation (*Avatar*) of god Vishnu. The main purpose of this incarnation is to demonstrate the righteous path (*dharma*) for all living creatures on earth.

42.9 Ramayana in popular culture

Multiple modern, English-language adaptations of the epic exist, namely *Ram Chandra Series* by Amish Tripathi, *Ramayana Series* by Ashok Banker and a mythopoetic novel, *Asura: Tale of the Vanquished* by Anand Neelakantan. Another Indian author, Devdutt Pattanaik, has published three different retellings and commentaries of *Ramayana* titled *Sita*, *The Book Of Ram* and *Hanuman's Ramayan*.

A number of plays, movies and television serials have also been produced based upon the *Ramayana*.

42.9.1 Stage

Starting in 1978 and under the supervision of Baba Hari Dass, *Ramayana* has been performed every year by Mount Madonna School in Watsonville, California. Currently, it is the largest yearly, Western version of the epic being performed. It takes the form of a colorful musical with custom costumes, sung and spoken dialog, jazz-rock orchestration and dance. This performance takes place in a large audience theater setting usually in June, in San Jose, CA. Baba Hari Dass has taught acting arts, costume-attire design, mask making and choreography to bring alive characters of Sri Ram, Sita, Hanuman, Lakshmana, Shiva, Parvati, Vibhishan, Jatayu, Sugriva, Surpanakha, Ravana and



Rama (Yama) and Sita (Me Thida) in Yama Zatdaw, Burmese version of Ramayana.

his rakshasa court, Meghnadha, Kumbhakarna and the army of monkeys and demons.



A Ramlila actor wears the traditional attire of Ravana.

42.9.2 Movies

- Sampoorana Ramayanam (1958 film) – A Telugu movie starring N. T. Rama Rao (1958).
- Sampoorana Ramayana– A Hindi film directed by Babubhai Mistry (1961).
- Lava Kusha – A Uttara Kanda-based bilingual Telugu movie and Tamil movie starring N. T. Rama Rao (1963).
- Sampoorana Ramayanamu – A Telugu film directed by Bapu, starring Sobhan Babu, Chandrakala, S V Ranga Rao (1971).
- Kanchana Sita – A Malayalam film by G. Aravindan (1977).
- Ramayana: The Legend of Prince Rama – A Japanese animated film released in the Hindi, Japanese and English languages (1992).
- Opera Jawa – An Indonesian-Austrian film in the Indonesian language; inspired by the story of the abduction of Sita (2008).
- Sita Sings the Blues – An independent animated film (2008).
- Lava Kusa: The Warrior Twins – Animated film based on Uttara Kanda (2010).
- Ramayana: The Epic – A Warner Bros. Indian animated film (2010).
- Sri Rama Rajyam – Movie based on Uttara Kanda, Telugu a film starring Nandamuri Balakrishna (2011).
- Yak: The Giant King – A re-interpretation of Ramayana, the Thai animation film tells the story of a giant robot, Na Kiew, who is left wandering in a barren wasteland after a great war. Na Kiew meets Jao Phuek, a puny tin robot who has lost his memory and is now stuck with his new big friend. Together they set out across the desert populated by metal scavengers, to look for Ram, the creator of all robots. (2012).
- Mumbai Musical – DreamWorks Animation (2016).
- Mahayoddha Rama – An animated version of Ramayana from the perspective of Ravana, the demon king of Lanka.



Deities Sita (far right), Rama (center), Lakshmana (far left) and Hanuman (below, seated) at Bhaktivedanta Manor, Watford, England

42.9.3 Plays

- Kanchana Sita (play), *Saketham* and *Lankalakshmi* – award-winning trilogy by Malayalam playwright C. N. Sreekantan Nair.
- Lankeswaran – play by award-winning Tamil cinema actor R. S. Manohar.
- King's Dharma – A multi-media production produced by Ben Kahan and Andreas Canning (2016).* [16]

42.9.4 TV series

- Ramayan (TV series) – Originally broadcast on Doordarshan, produced by Ramanand Sagar in 1987.
- Jai Hanuman – Originally broadcast on Doordarshan, produced and directed by Sanjay Khan.
- Ramayan (2002) – Originally broadcast on Zee TV, produced by BR Films.
- Ramayan (2008 TV series) – Originally broadcast on Imagine TV, produced by Ramanand Sagar.
- Ramayan (2012 TV Series) – A remake of the 1987 series and aired on Zee TV.
- *Antariksh* (2004) – A sci-fi version of Ramayan. Originally broadcast on Star Plus.
- Raavan (TV series) – series on life of Ravana based on Ramayana. Originally broadcast on Zee TV.
- Sankatmochan Mahabali Hanuman – 2015 series based on life of Hanuman presently broadcasting on Sony TV.
- Siya Ke Ram – a series on Star Plus, originally broadcast from November 16, 2015 to November 4, 2016.

42.10 See also

- Adam's Bridge
- Indian Numbering System#Vedic numbering systems
- Rama
- Reamker
- Three Hundred Ramayanas: Five Examples and Three Thoughts on Translation, a controversial essay by A. K. Ramanujan

42.11 Citations

- [1] "Ramayana" . *Random House Webster's Unabridged Dictionary*.
- [2] Mukherjee Pandey, Jhimli (18 Dec 2015). "6th-century Ramayana found in Kolkata, stuns scholars" . timesofindia.indiatimes.com. TNN. Retrieved 20 December 2015.
- [3] Uma Singh, Senu Singh (16 January 2013). "Ramayan as a complete life of real human" (PDF). *Indian Journal of Arts*. **1** (1): 2. Retrieved 20 November 2016.
- [4] Mukherjee, P. (1981). *The History of Medieval Vaishnavism in Orissa*. Asian Educational Services. p. 74. ISBN 9788120602298. Retrieved 6 January 2017.
- [5] *Living Thoughts of the Ramayana*. Jaico Publishing House. 2002. ISBN 9788179920022. Retrieved 6 January 2017.
- [6] Krishnamoorthy, K.; Mukhopadhyay, S.; Sahitya Akademi (1991). *A Critical Inventory of Rāmāyaṇa Studies in the World: Foreign languages*. Sahitya Akademi in collaboration with Union Académique Internationale, Bruxelles. ISBN 9788172015077. Retrieved 6 January 2017.
- [7] Bulcke, C.; Prasāda, D. (2010). *Rāmakathā and Other Essays*. Vani Prakashan. p. 116. ISBN 9789350001073. Retrieved 6 January 2017.
- [8] *CANTO LXVII.: THE BREAKING OF THE BOW*. sacredtexts.com. Retrieved 25 January 2016.
- [9] Rajarajan, R.K.K. (2001) *Sītāpaharaṇam*: Changing thematic Idioms in Sanskrit and Tamil. In Dirk W. Lonne ed. *Tofha-e-Dil: Festschrift Helmut Nespital*, Reinbeck, 2 vols., pp. 783-97. ISBN 3-88587-033-9. https://www.academia.edu/2514821/S%C4%ABt%C4%81pahara%E1%B9%89am_Changing_thematic_Idioms_in_Sanskrit_and_Tamil
- [10] Rajarajan, R.K.K. (2014) Reflections on "Rāma-Setu" in South Asian Tradition. *The Quarterly Journal of the Mythic Society*, Vol. 105.3: 1-14, ISSN 0047-8555. https://www.academia.edu/8779702/Reflections_on_R%C4%81ma-Setu_in_South_Asian_Tradition
- [11] Jones, Constance; Ryan, James D. (1 January 2006). *Encyclopedia of Hinduism*. Infobase Publishing. ISBN 9780816075645.
- [12] *Journal of the Straits Branch of the Royal Asiatic Society*. 1898. pp. 107–.
- [13] *Journal of the Straits Branch of the Royal Asiatic Society*. 1898. pp. 143–.
- [14] "Ramayana Translation Project turns its last page, after four decades of research | Berkeley News" . news.berkeley.edu. Retrieved 6 January 2017.
- [15] "UC Berkeley researchers complete decades-long translation project | The Daily Californian" . dailycal.org. Retrieved 6 January 2017.
- [16] "Welcome" . *King's Dharma*. Retrieved 10 October 2016.

42.12 References

- Arya, Ravi Prakash (ed.). *Ramayana of Valmiki: Sanskrit Text and English Translation*. (English translation according to M. N. Dutt, introduction by Dr. Ramashraya Sharma, 4-volume set) Parimal Publications: Delhi, 1998, ISBN 81-7110-156-9
- Bhattacharji, Sukumari (1998). *Legends of Devi*. Orient Blackswan. p. 111. ISBN 978-81-250-1438-6.
- Brockington, John (2003). “The Sanskrit Epics” . In Flood, Gavin. *Blackwell companion to Hinduism*. Blackwell Publishing. pp. 116–128. ISBN 0-631-21535-2.
- Buck, William; van Nooten, B. A. (2000). *Ramayana*. University of California Press. p. 432. ISBN 978-0-520-22703-3.
- Dutt, Romesh C. (2004). *Ramayana*. Kessinger Publishing. p. 208. ISBN 978-1-4191-4387-8.
- Dutt, Romesh Chunder (2002). *The Ramayana and Mahabharata condensed into English verse*. Courier Dover Publications. p. 352. ISBN 978-0-486-42506-1.
- Fallon, Oliver (2009). *Bhatti's Poem: The Death of Ravana (Bhaṭṭikāvya)*. New York: New York University Press, Clay Sanskrit Library. ISBN 978-0-8147-2778-2.
- Keshavadas, Sadguru Sant (1988). *Ramayana at a Glance*. Motilal Banarsidass Publ., p. 211. ISBN 978-81-208-0545-3.
- Goldman, Robert P. (1990). *The Ramayana of Valmiki: An Epic of Ancient India: Balakanda*. Princeton University Press. ISBN 978-0-691-01485-2.
- Goldman, Robert P. (1994). *The Ramayana of Valmiki: An Epic of Ancient India: Kiskindhakanda*. Princeton University Press. ISBN 978-0-691-06661-5.
- Goldman, Robert P. (1996). *The Ramayana of Valmiki: Sundarakanda*. Princeton University Press. ISBN 978-0-691-06662-2.
- Mahulikar, Dr. Gauri. *Effect Of Ramayana On Various Cultures And Civilisations*, Ramayan Institute
- Rabb, Kate Milner, *National Epics*, 1896 – see eText in Project Gutenberg
- Murthy, S. S. N. (November 2003). “A note on the Ramayana” (PDF). *Electronic Journal of Vedic Studies*. New Delhi. **10** (6): 1–18. ISSN 1084-7561.
- Prabhavananda, Swami (1979). *The Spiritual Heritage of India*. Vedanta Press. p. 374. ISBN 978-0-87481-035-6. (see also Wikipedia article on book)
- Raghunathan, N. (transl.), *Srimad Valmiki Ramayanam*, Vighneswara Publishing House, Madras (1981)
- Rohman, Todd (2009). “The Classical Period” . In Watling, Gabrielle; Quay, Sara. *Cultural History of Reading: World literature*. Greenwood. ISBN 978-0-313-33744-4.
- Sattar, Arshia (transl.) (1996). *The Rāmāyaṇa by Vālmiki*. Viking. p. 696. ISBN 978-0-14-029866-6.
- Sundararajan, K.R. (1989). “The Ideal of Perfect Life : The Ramayana” . In Krishna Sivaraman; Bithika Mukerji. *Hindu spirituality: Vedas through Vedanta*. The Crossroad Publishing Co. pp. 106–126. ISBN 978-0-8245-0755-8.
- *A different Song* – Article from “The Hindu” 12 August 2005 – “The Hindu : Entertainment Thiruvananthapuram / Music : A different song” . Hinduonnet.com. 12 August 2005. Archived from the original on 27 October 2010. Retrieved 1 September 2010.
- *Valmiki's Ramayana illustrated with Indian miniatures from the 16th to the 19th century*, 2012, Editions Diane de Selliers, ISBN 9782903656768

42.13 Further reading

Sanskrit text

- Electronic version of the Sanskrit text, input by Muneo Tokunaga
- Sanskrit text on GRETIL

Translations

- Valmiki Ramayana verse translation by Desiraju Hanumanta Rao, K. M. K. Murthy et al.
- Valmiki Ramayana translated by Ralph T. H. Griffith (1870–1874) (Project Gutenberg)
- *The Ramayana condensed into English verse* by R. C. Dutt (1899) at archive.org
- Prose translation of the complete *Ramayana* by M. N. Dutt (1891–1894): Balakandam, Ayodhya Kandam, Aranya Kandam, Kishkindha Kandam, Sundara Kandam, Yuddha Kandam, Uttara Kandam
- *Rāma the Steadfast: an early form of the Rāmāyaṇa* translated by J. L. Brockington and Mary Brockington. Penguin, 2006. ISBN 0-14-044744-X.
- *Geet Ramayan* literally "Ramayan in verse" in Marathi by G. D. Madgulkar*[1]

Secondary Sources

- Jain, Meenakshi. (2013). *Rama and Ayodhya*. Aryan Books International, 2013.

42.14 External links

- A condensed verse translation by Romesh Chunder Dutt sponsored by the Liberty Fund
- The *Ramayana* as a Monomyth from UC Berkeley (archived)

[1] Bose, Mandakranta (Editor); Aklujkar, Vidut (Author) (2004). *The Rāmāyaṇa revisited* (Online ed.). Oxford: Oxford University Press. pp. 260–273. ISBN 978-0195168334. Retrieved 9 December 2016.

Chapter 43

Toyota Production System

The **Toyota Production System (TPS)** is an integrated socio-technical system, developed by Toyota, that comprises its management philosophy and practices. The TPS organizes manufacturing and logistics for the automobile manufacturer, including interaction with suppliers and customers. The system is a major precursor of the more generic "lean manufacturing". Taiichi Ohno and Eiji Toyoda, Japanese industrial engineers, developed the system between 1948 and 1975.*[1]

Originally called "just-in-time production", it builds on the approach created by the founder of Toyota, Sakichi Toyoda, his son Kiichiro Toyoda, and the engineer Taiichi Ohno. The principles underlying the TPS are embodied in The Toyota Way.

43.1 Goals

The main objectives of the TPS are to design out overburden (*muri*) and inconsistency (*mura*), and to eliminate waste (*muda*). The most significant effects on process value delivery are achieved by designing a process capable of delivering the required results smoothly; by designing out “mura” (inconsistency). It is also crucial to ensure that the process is as flexible as necessary without stress or “muri” (overburden) since this generates “muda” (waste). Finally the tactical improvements of waste reduction or the elimination of muda are very valuable. There are eight kinds of muda that are addressed in the TPS:*[2]

1. Waste of overproduction (largest waste)
2. Waste of time on hand (waiting)
3. Waste of transportation
4. Waste of processing itself
5. Waste of stock at hand
6. Waste of movement
7. Waste of making defective products
8. Waste of underutilized workers

The elimination of waste has come to dominate the thinking of many when they look at the effects of the TPS because it is the most familiar of the three to implement. In the TPS many initiatives are triggered by inconsistency or over-run reduction which drives out waste without specific focus on its reduction.

43.2 Concept of TPS

Toyota Motor Corporation has published an official description of TPS for the first time in 1992; this booklet was revised in 1998.*[3] In the foreword it was said: "The TPS is a framework for conserving resources by eliminating

waste. People who participate in the system learn to identify expenditures of material, effort and time that do not generate value for customers and furthermore we have, avoid a 'how-to' approach. The booklet is not a manual. Rather it is an overview of the concepts, that underlie our production system. It is a reminder that lasting gains in productivity and quality are possible whenever and wherever management and employees are united in a commitment to positive change". TPS is grounded on two main conceptual pillars:

1. *Just-in-time* * [4] - meaning "Making only what is needed, only when it is needed, and only in the amount that is needed"
2. *Jidoka* * [5] - (Autonomation) meaning "Automation with a human touch"

Toyota has developed various tools to transfer these concepts into practice and apply them to specific requirements and conditions in the company and business.

43.3 Origins

This system, more than any other aspect of the company, is responsible for having made Toyota the company it is today. Toyota has long been recognized as a leader in the automotive manufacturing and production industry. * [6]

Industrial Engineering is the wider science behind TPS.

It is a myth that "Toyota received their inspiration for the system, not from the American automotive industry (at that time the world's largest by far), but from visiting a supermarket". The idea of Just-in-time production was originated by *Kiichiro Toyoda*, founder of Toyota. * [7] The question was how to implement the idea. In reading descriptions of American supermarkets, Ohno saw the supermarket as the model for what he was trying to accomplish in the factory. A customer in a supermarket takes the desired amount of goods off the shelf and purchases them. The store restocks the shelf with enough new product to fill up the shelf space. Similarly, a work-center that needed parts would go to a "store shelf" (the inventory storage point) for the particular part and "buy" (withdraw) the quantity it needed, and the "shelf" would be "restocked" by the work-center that produced the part, making only enough to replace the inventory that had been withdrawn. * [2] * [8]

While low inventory levels are a key outcome of the Toyota Production System, an important element of the philosophy behind its system is to work intelligently and eliminate waste so that only minimal inventory is needed. * [7] Many Western businesses, having observed Toyota's factories, set out to attack high inventory levels directly without understanding what made these reductions possible. * [9] The act of imitating without understanding the underlying concept or motivation may have led to the failure of those projects.

43.4 Principles

Main article: *The Toyota Way*

The underlying principles, called the Toyota Way, have been outlined by Toyota as follows: * [10] * [11]

43.4.1 Continuous improvement

- **Challenge** (We form a long-term vision, meeting challenges with courage and creativity to realize our dreams.)
- **Kaizen** (We improve our business operations continuously, always driving for innovation and evolution.)
- **Genchi Genbutsu** (Go to the source to find the facts to make correct decisions.)

43.4.2 Respect for people

- **Respect** (We respect others, make every effort to understand each other, take responsibility and do our best to build mutual trust.)

- **Teamwork** (We stimulate personal and professional growth, share the opportunities of development and maximize individual and team performance.)

External observers have summarized the principles of the Toyota Way as: ^{*}[12]

43.4.3 Long-term philosophy

1. Base your management decisions on a long-term philosophy, even at the expense of short-term financial goals.

43.4.4 The right process will produce the right results

1. Create continuous process flow to bring problems to the surface.
2. Use the “pull” system to avoid overproduction.
3. Level out the workload (*heijunka*). (Work like the tortoise, not the hare.)
4. Build a culture of stopping to fix problems, to get quality right from the first. (*Jidoka*)
5. Standardized tasks are the foundation for continuous improvement and employee empowerment.
6. Use visual control so no problems are hidden.
7. Use only reliable, thoroughly tested technology that serves your people and processes.

43.4.5 Add value to the organization by developing your people and partners

1. Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others.
2. Develop exceptional people and teams who follow your company's philosophy.
3. Respect your extended network of partners and suppliers by challenging them and helping them improve.

43.4.6 Continuously solving root problems drives organizational learning

1. Go and see for yourself to thoroughly understand the situation (*Genchi Genbutsu*, 現地現物);
2. Make decisions slowly by consensus, thoroughly considering all options (*Nemawashi*, 根回し); implement decisions rapidly;
3. Become a learning organization through relentless reflection (*Hansei*, 反省) and continuous improvement (*Kaizen*, 改善).

The Toyota production system has been compared to squeezing water from a dry towel. What this means is that it is a system for thorough waste elimination. Here, waste refers to anything which does not advance the process, everything that does not increase added value. Many people settle for eliminating the waste that everyone recognizes as waste. But much remains that simply has not yet been recognized as waste or that people are willing to tolerate.

People had resigned themselves to certain problems, had become hostage to routine and abandoned the practice of problem-solving. This going back to basics, exposing the real significance of problems and then making fundamental improvements, can be witnessed throughout the Toyota Production System. ^{*}[13]

43.5 Sharing

Toyota originally began sharing TPS with its parts suppliers in the 1990s. Because of interest in the program from other organizations, Toyota began offering instruction in the methodology to others. Toyota has even “donated” its system to charities, providing its engineering staff and techniques to non-profits in an effort to increase their efficiency and thus ability to serve people. For example, Toyota assisted the **Food Bank For New York City** to significantly decrease waiting times at soup kitchens, packing times at a food distribution center, and waiting times in a food pantry. ^{*}[14]

43.6 Workplace Management

Taiichi Ohno's *Workplace Management* (2007) outlines in 38 chapters how to implement the TPS system. Some important concepts are:

- Chapter 1 *Wise Mend Their Ways* - See the *Analects of Confucius* for further information.
- Chapter 4 *Confirm Failures With Your Own Eyes*
- Chapter 11 *Wasted Motion Is Not Work*
- Chapter 15 *Just In Time* - Phrase invented by Kiichiro Toyoda - the first president of Toyota. There is conflict on what the actual English translation of what “just in time” really means. Taiichi Ohno quoted from the book says " 'Just In Time' should be interpreted to mean that it is a problem when parts are delivered too early” .*[15]
- Chapter 23 *How To Produce At A Lower Cost* - “One of the main fundamentals of the Toyota System is to make 'what you need, in the amount you need, by the time you need it', but to tell the truth there is another part to this and that is 'at lower cost'. But that part is not written down.” *[15] World economies, events, and each individual job also play a part in production specifics.

43.7 Commonly used terminology

- **Andon** (行灯) (English: A large lighted board used to alert floor supervisors to a problem at a specific station. Literally: Signboard)
- **Chaku-Chaku** (着々 or 着着) (English: Load-Load)* [16]
- **Gemba** (現場) (English: The actual place, the place where the real work is done; On site)
- **Genchi Genbutsu** (現地現物) (English: Go and see for yourself)
- **Hansei** (反省) (English: Self-reflection)
- **Heijunka** (平準化) (English: Production Smoothing)
- **Jidoka** (自動化) (English: Autonomation - automation with human intelligence)
- **Just-in-Time** (ジャストインタイム) (JIT)
- **Kaizen** (改善) (English: Continuous Improvement)
- **Kanban** (看板, also かんばん) (English: Sign, Index Card)
- **Manufacturing supermarket** where all components are available to be withdrawn by a process
- **Muda** (無駄, also ムダ) (English: Waste)
- **Mura** (斑 or ムラ) (English: Unevenness)
- **Muri** (無理) (English: Overburden)
- **Nemawashi** (根回し) (English: Laying the groundwork, building consensus, literally: Going around the roots)
- **Obeya** (大部屋) (English: Manager's meeting. Literally: Large room, war room, council room)
- **Poka-yoke** (ポカヨケ) (English: fail-safing, bulletproofing - to avoid (*yokeru*) inadvertent errors (*poka*))
- **Seibi** (English: To Prepare)
- **Seiri** (整理) (English: Sort, removing whatever isn't necessary.)* [16]
- **Seiton** (整頓) (English: Organize)* [16]
- **Seiso** (清掃) (English: Clean and inspect)* [16]
- **Seiketsu** (清潔) (English: Standardize)* [16]
- **Shitsuke** (躰) (English: Sustain)* [16]

43.8 See also

- Lean construction
- The Vanguard Method
- W. Edwards Deming
- Training Within Industry

43.9 References

- [1] Strategos-International. **Toyota Production System and Lean Manufacturing.**
- [2] Ohno, Taiichi (March 1998), *Toyota Production System: Beyond Large-Scale Production*, Productivity Press, ISBN 978-0-915299-14-0
- [3] Toyota Motor Corporation: *The Toyota Production System – Leaner manufacturing for a greener planet*; TMC, Public Affairs Division, Tokyo, 1998
- [4] ibidem, p. 11 ff.
- [5] ibidem, p. 25 ff.
- [6] Brian Bremner, B. and C. Dawson (November 17, 2003). “Can Anything Stop Toyota?: An inside look at how it's reinventing the auto industry” . *Business Week*.
- [7] Ohno, Taiichi (March 1988), *Just-In-Time For Today and Tomorrow*, Productivity Press, ISBN 978-0-915299-20-1
- [8] Magee, David (November 2007), *How Toyota Became #1 - Leadership Lessons from the World's Greatest Car Company*, Portfolio Hardcover, ISBN 978-1-59184-179-1
- [9] Goldratt, Eliyahu M. (1990). *What is this thing called Theory of Constraints and how should it be implemented?*. North River Press. pp. 31–32.
- [10] Toyota internal document, “The Toyota Way 2001,” April 2001
- [11] Toyota Motor Corporation Sustainability Report, 2009, page 54
- [12] Liker, J. 2004. *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer*.
- [13] A study of the Toyota Production System, Shigeo Shingo, Productivity Press, 1989, p236
- [14] El-Naggar, Mona (26 July 2013). “In Lieu of Money, Toyota Donates Efficiency to New York Charity” . *The New York Times*. Retrieved 1 September 2013.
- [15] Ohno, Taiichi (2007), *Workplace Management*. Translated by Jon Miller, Gemba Press, ISBN 978-0-9786387-5-7, ISBN 0-9786387-5-1
- [16] “Glossary of Lean Terms” .

43.10 Bibliography

- Emiliani, B., with Stec, D., Grasso, L. and Stodder, J. (2007), *Better Thinking, Better Results: Case Study and Analysis of an Enterprise-Wide Lean Transformation*, second edition, The CLBM, LLC Kensington, Conn., ISBN 978-0-9722591-2-5
- Liker, Jeffrey (2003), *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer*, First edition, McGraw-Hill, ISBN 0-07-139231-9.
- Monden, Yasuhiro (1998), *Toyota Production System, An Integrated Approach to Just-In-Time*, Third edition, Norcross, GA: Engineering & Management Press, ISBN 0-412-83930-X.
- Ohno, Taiichi (1988), *Just-In-Time for Today and Tomorrow*, Cambridge, MA: Productivity Press, ISBN 0915299208

- Ohno, Taiichi (1988), *Toyota Production System: Beyond Large-Scale Production*, Cambridge, MA: Productivity Press, ISBN 0915299143
- Ohno, Taiichi (1988), *Workplace Management*, Cambridge, MA: Productivity Press, ISBN 0915299194
- Shingo, Shigeo; Dillon, Andrew (1989), *A study of the Toyota production system from an industrial engineering viewpoint (Produce What Is Needed, When It's Needed)*, Portland, OR: Productivity Press, ISBN 0-915299-17-8, OCLC 19740349
- Spear, Steven, and Bowen, H. Kent (September 1999), “Decoding the DNA of the Toyota Production System,” *Harvard Business Review*
- Womack, James P. and Jones, Daniel T. (2003), *Lean Thinking: Banish Waste and Create Wealth in Your Corporation, Revised and Updated*, HarperBusiness, ISBN 0-7432-4927-5.
- Womack, James P., Jones, Daniel T., and Roos, Daniel (1991), *The Machine That Changed the World: The Story of Lean Production*, HarperBusiness, ISBN 0-06-097417-6.

43.11 External links

- [Toyota Production System](#)
- [History of the TPS at the Toyota Motor Manufacturing Kentucky Site](#)
- [Toyota Production System Terms](#)
- [Article: Lean Primer: Introduction](#)

43.12 Text and image sources, contributors, and licenses

43.12.1 Text

- **Beneficial weed** *Source:* https://en.wikipedia.org/wiki/Beneficial_weed?oldid=770253614 *Contributors:* GTBacchus, Tomchiukc, Imroy, Kazvorpai, Richard Arthur Norton (1958-), Rjwilmsi, PKM, Dddddd, Hellbus, Pseudomonas, Malcolma, SmackBot, Rkitko, Cybercobra, Clicketyclack, SilkTork, SQGibbon, CmdrObot, Juhachi, FluridCube, Coreydragon, Vultur-enwiki, WLU, Jerry, Fleebo, Steorra, Sfan00 IMG, Addbot, Quercus solaris, AnomieBOT, Apothecia, Jonathon A H, OgreBot, Dupie137, Kibi78704, Waso99, Look2See1, BG19bot, Shinkafari, TylerDurden8823, Cathry, Debouch, Mohamed-Ahmed-FG, Karinpower, InternetArchiveBot and Anonymous: 17
- **Failure in the intelligence cycle** *Source:* https://en.wikipedia.org/wiki/Failure_in_the_intelligence_cycle?oldid=757168627 *Contributors:* Dbabbitt, Beland, Discospinster, Woohookitty, GraemeLeggett, Rjwilmsi, Bgwhite, Stephenb, Grafen, Chris the speller, Lambiam, Iridescent, CmdrObot, Swpb, R'n'B, Toddy1, Blow of Light, Belatrimmel, Reedmalloy, Yobot, Gilo1969, FrescoBot, Blackguard SF, Citation bot 1, Full-date unlinking bot, John of Reading, Snotbot, Helpful Pixie Bot, ArmbrustBot, Monkbot, InternetArchiveBot and Anonymous: 12
- **Job's tears** *Source:* https://en.wikipedia.org/wiki/Job%7B%7D%27s_tears?oldid=779522924 *Contributors:* Dale Arnett, DHN, Giftlite, DocWatson42, Andycjp, Oknazevad, Dr.frog, DanielCD, Kdammers, Reinyday, Hesperian, Sjschen, Versageek, Abanima, Stemonitis, Pekinensis, Dysepion, Rjwilmsi, Ricardo Carneiro Pires, Vuong Ngan Ha, Daderot, Eubot, Chobot, Gdrbot, YurikBot, RussBot, Badagnani, Apokryltaros, Hare, Marknesbitt, Bota47, Asarelah, Bayerischermann, Gyuen, Ilmari Karonen, Kintetsubuffalo, Edgar181, Octahe-dron80, DHN-bot-enwiki, Zzorse, LDHan, NongBot-enwiki, Newone, Tau'olunga, Cydebot, Dusty relic, Thijs!bot, Ufwuct, Dezidor, JAnDbot, Tengu99, Rich257, Peter coxhead, Mermaid from the Baltic Sea, Geekdiva, Random Passer-by, Horstvonludwig, Caspian blue, VolkovBot, Philip Trueman, Vipinhari, Katimawan2005, Temporaluser, Azukimonaka, LeadSongDog, Liuzhou, No such user, Dantelebeau, Craigallan.za, InMemoriamLuangPu, Kembangraps, Addbot, Cuaxdon, Luckas-bot, Yobot, Burgundo, AnomieBOT, Jay L09, Nasnema, Tomas62, RibotBOT, Andromedas, Zantesantiago, Citation bot 1, Krish Dulal, Kee84, EmausBot, Look2See1, Dcirovic, ZéroBot, Jenks24, Suslindisambiguator, Rigley, ClueBot NG, Cosmicjay, Plantdrew, ElphiBot, PL230Fahmy, CitationCleanerBot, Cahz, Siuenti, Jennyhoople, Ceosad, Julietdeltalima, InternetArchiveBot, Ityopyyawit, Hellosabirina2017 and Anonymous: 47
- **John Titor** *Source:* https://en.wikipedia.org/wiki/John_Titor?oldid=782268876 *Contributors:* Mav, The Anome, LukeyBoy, Shii, ChangChienFu, Maury Markowitz, Infrogmation, Tubby, DopefishJustin, MartinHarper, Bobby D. Bryant, Eurlief, CesarB, Egil, Ahoerstemeier, William M. Connelly, Mark Foskey, Julesd, Vzbs34, Lee M, Jonik, Ilyanep, Smack, Vodex, David Latapie, Slark, Rvolz, Wik, Maximus Rex, Nv8200pa, Wiwaxia, AnonMoos, Johnleemk, Jni, PuzzletChung, Plehn, Popageorgio, Astronautics-enwiki, Fredrik, Chris 73, Boffy b, Choclateboy, Altenmann, Keir-enwiki, Academic Challenger, Litefantastic, Andrew Levine, Bkell, Geeklizzard, Catbar, Hadal, White dolomite, Wereon, ElBenevolente, Drstuey, Mattflaschen, DocWatson42, Brouhaha, Lee J Haywood, Tom harrison, Lupin, Fastfission, Everyking, Snowdog, Unconcerned, Mboverload, Lahtalion, Tagishsimon, Keith Edkins, Alexf, Toytoy, Cbraga, Yath, LucasVB, Quadell, Beland, OverlordQ, Robert Brockway, MadIce, Khaosworks, Kuralyov, Eichberger-enwiki, Kmweber, Goobergunch, Benzhenwiki, Subsume, Adashiel, Neschek, Eep², Alkivar, Ouro, Lehi, Mark Zinthefer, Rich Farmbrough, Guanabot, O.F.Fascist, ArnoldReinhold, User2004, Batkins, Kzzl, Xezbeth, GregoryWeir, Jarsyl, Danakil, Ylee, CanisRufus, Lycurgus, Richard W.M. Jones, CXI, Zegoma beach, Susvolans, RoyBoy, Phiwum, 2005, Underdog-enwiki, Causa sui, Rpresser, Bobo192, Hurricane111, 23skidoo, Infocidal, Cheesegoduk, John Vandenberg, Foobaz, Mrbill, Redit, Forteanajones, Larryv, B0at, TACD, Craptree, Klhuillier, Avian, Mduvekot, Guy Harris, Free Bear, Keenan Pepper, Hadmatter, Richard Fannin, Hoary, Lightdarkness, Mysdaao, Bart133, Cortonin, NerfHerder, SidP, Cryomaniac, Suruena, Geraldshields11, Deathphoenix, Joshbrez, Iustinus, Netkinetic, Jweed, TeamUnderhill, Bookandcoffee, Markaci, Red dwarf, Dismas, Japanese Searobin, Ron Ritzman, Mullet, OwenX, Woohookitty, Jacen Aratan, DoctorWho42, Aldiboronti, Daniel Case, Madchester, Chochopk, Alfakim, Pufferfish101, KevinOKeefe, GregorB, Tsunade, Pictureuploader, Psi edit, Shwhawking, Daaku, Rusty2005, Phlebas, Rufous, EggplantWizard, Graham87, Hjweth, A Train, Cuchullain, BD2412, FreplySpang, Pmj, Rjwilmsi, Koavf, Tawker, Jbadder, Dudegalea, Sferrier, TheIncredibleEdibleOompaLoompa, MikeJ9919, Wikifier, Titoxd, Wragge, VKokielov, Naraht, Rustyrale, Chanting Fox, Fraggle, Supertrouperdc, Imnotminkus, Acefitt, Lucashoal, Masnevets, POTA, King of Hearts, CJLL Wright, Chobot, Michaelritchie200, Soyweiser, Spasemunki, Bgwhite, Ariasne, Quicksilvre, FrankTobia, Wavelength, Angus Lepper, Argav, Edward Wakelin, Petrus4, WikidSmaht, Lobsterkins, MORHI, Sikon, Gaius Cornelius, Kyorosuke, Rsrikanth05, Cryptic, Wimt, Ugur Basak, Panboom, Mipadi, Anomo, Aeusoes1, RattleMan, Kuroji, Cquan, Trovatore, D-Katana, Tailpig, Nsmith 84, JDoorjam, Irishguy, Retired username, Inhighspeed, Moe Epsilon, MSJapan, Spupirrit, Denis C., Cassandra423, Engineer Bob, Tlevine, Kmmontandon, NorsemanII, Zero1328, Theda, Arthur Rubin, GIR, Croat Canuck, Smurrayinchester, Marco Passarani, Jolb, Arkon, Lawyer2b, One, Yahnatat, SmackBot, Avengerx, ZAROVE, Herostratus, KnowledgeOfSelf, CelticJobber, Hydrogen Iodide, McGeddon, Jagged 85, Michaelbeckham, RedSpruce, Eskimbot, Kangy, Vilerage, Alex earlier account, Ruarc, Blackfield, Xaosflux, Yamaguchi 先生, Gilliam, Portillo, Brenton.eccles, The Famous Movie Director, Skizzik, Ewok Slayer, DaveDrevello, JSpudeman, Macduff, Master Jay, Artofttransformation, Iain.dalton, Wellspring, Thumperward, Snori, Rorndoff, Moshe Constantine Hassan Al-Silverburg, CSWarren, Effer, Skase84, Colonies Chris, Antonrojo, Killingthedream, Can't sleep, clown will eat me, AMK152, Shunpiker, Nunocordeiro, Roguenine2000, ChaosSorcerer91, Jmlk17, BadgerBadger, Nakon, Savidan, Underbar dk, Sir Elderberry, Atou-enwiki, JGGardiner, Clean Copy, Katt, Ligulembot, Springnuts, ChaChaFut, Kukini, Will Beback, Synthe, Ser Amantio di Nicolao, Kuru, General Ization, Perfectblue97, Pilot expert, Jimd, Loadmaster, Grumpyyoungman01, Andypandy.UK, Robert Lindsay, Zooger, Hypnosifi, VelairWight, David-enwiki, Doczilla, Thedrizzle114, Condem, Wwagner, Nathanrdotcom, HisSpaceResearch, NEMT, Dave420, Ouzo-enwiki, Rangia2, Filter1987, Tawkerbot2, Pjalne, Truthhere, Pablopheanque, Xod, Jeremy Banks, Cyrusc, VoxLuna, CRGreathouse, CmdrObot, Ale jrb, Mattbr, TheHerbalGerbil, ChaosAkita, Desiromeo107, DarkMorford, Karaveks voice, Juhachi, Jedimasterchief9, Ken Gallager, 42omle, Equendil, ProfessorPaul, Cydebot, Lupine Proletariat, AniMate, SilvaStorm, Trasel, Maxdkandalf86, Crossmr, Lil g, Gogo Dodo, Bellerophon5685, Khatru2, Daniel J. Leivick, DumbBOT, Taschenrechner-enwiki, Djbatman, JodyB, LarryQ, Smiteri, DGX, Epr123, Birutorul, Kahteh, Mercury-enwiki, Maccess, Smees, Sestet, I do not exist, Brichcja, Nezzadar, IceSage, The Hybrid, Nhl4hamilton, Siraphec, AntiVandalBot, Gage14x, Primum mobile, Manushand, Dylan Lake, Flatassben, Credema, Markusbradley, Lembut, DagosNavy, MER-C, Aphanes, Lovok, PubliusFL, MLetterle, Metr0man, Cryptical, Garion333, VoABot II, Brian8710, Youth in Asia, Cadsuane Melaidhrin, Username550, WhatamIdoing, Ajihood, ArthurWeasley, 28421u2232nfencenc, Yongke, JaGa, Johnson Lau, Giantdevilfish, Wittyname, MartinBot, CliffC, Aviatora, The Blue Bubble, Poeloq, Anaxial, Smokizze, Wiki Raja, Danpetitpas, J.delanoy, Captain panda, Love Krittaya, Numbo3, JoDonHo, Ginsengbomb, Bobbyi, Joe Burd, Darth Mike, Ioioiooops, Garth of NEaB, Katharineamy, Fairness And Accuracy For All, Monday, Tontoe, Makowsky, Big Pappa K, The Mooninites, Bushcarrot, Jrdepriest, Kansas Bear, Romosapien, The-moodyblue, Shadow Android, Cometstyles, FuegoFish, Jtherlow, Pancasila-enwiki, VolkovBot, ABF, Murderbike, Temporarily Insane, Paranormalis, Hersfold, Jeff G., Philip Trueman, Oshwah, Malinaccier, Pwnage8, Alan950, Ann Stouter, Qxz, Abbail, RaelRode, Metatron's Cube, Martin451, LeaveSleaves, DjVince, 4kinnel, Aliasd, CO, Shogi war, Michaelsuarez, Zalinda Zenobia, Marijuanarchy,

Kevinbi2004, Sai2020, Burntsauce, Sapphic, Spinningspark, Recall15, Vid2vid, Life, Liberty, Property, Flakblaster, Yelling Bird, Websterphreaky, Daveh4h, Hazel77, Jitor, Megan.rw1, John Tit, Mydoom111, Voldemore, WRK, Interchange88, Travishafer1992, Spinlock bob, Mimihitam, JJBeat, Lightmouse, Tombomp, Barryzed, Zylox, Patchwork667, Karsten11, Mr. Stradivarius, Nimtard, Superbeecat, Pinkadelica, Tegrenath, Lanfear's Bane, Kanonkas, Jimmys1090, Perryar, ClueBot, Philip208, Jwpark83, Abe Froman9, Bishop205, Rockgod796, MIDI, Humanist Wikitopian, RODERICKMOLASAR, Yankee-Whiskey-Papa, TheOldJacobite, SuperHamster, CounterVandalismBot, Truetruetrue, Trivialist, Jackins, Supergodzilla2090, Luke4545, Excirial, CohesionBot, Alexbot, Ishacalls, Arjayay, Alamo14, Tnxman307, Razorflame, Antiquary, Versus22, MelonBot, Bearsona, XLinkBot, Jovianeye, Jadawg15, Allsaints23, ESO Fan, Good Olfactory, Totlmstr, Kbdankbot, Addbot, Simonm223, Nohomers48, Ronhjones, JackorKnav, Jefflithe, Glass Sword, Tide rolls, Iune, Ilgyu, Max42, Luckas-bot, Yobot, Fraggie81, Amirobot, Type1warlord, THEN WHO WAS PHONE?, Nallimbob, Abeir-Toril, K2709, 4th-otaku, Keep your fork, there's pie, AnomieBOT, DoctorJoeE, Jim1138, Onnozele, Ambrosiaster, Theleaderof2900, Flewis, Titor, Kelpiedog911, MaterialsScientist, Miklee-enwiki, Ian Bouystress, Xqbot, NorwalkJames, Jeffwang, Jumbali-enwiki, Raphaelfilms, Alumnun, Naratongki, Grenada4fun, A.amitkumar, Cellularmonkey, Blackguard SF, Anonymous2036, GodivaCake, Kziegman, Luca marconato, Ilikegeorgelopez, Supergeekfreak, Aldy, JIK1975, Potatoduck, Spicywonton, BestCoolGuy22, Dkoalat, MastiBot, Law De-Schilde, Fixer88, Call me LORDiNFAMOUS, 2012WorldPeace, Raphaelgiovanni, Trappist the monk, DriveMySol, Glitterballband, Cbayley2001, Active Banana, Winner 42, Evanh2008, AvicBot, ZéroBot, Illegitimate Barrister, Hd like apples, SpencerCollins, John-titor2.0, Coasterlover1994, Ego White Tray, Bschuman, Tentontunic, Darkfinish, ClueBot NG, MelbourneStar, GuzzuG, Widr, Helpful Pixie Bot, Czetie, Titodutta, Calabe1992, Trunks ishida, BG19bot, Noopur28, TeeVeed, HappySuiside, Muccaneve, Harizotoh9, MrBill3, Kencrapalot, BattyBot, ~riley, Cyberbot II, Brentnauer, None but shining hours, Rschnd, Spirit of Eagle, Joshtaco, Buzz202, Johnson.s.erik, Vember94, Epicgenius, PhilWrite, Ilovetopaint, Paul2520, Anythingcouldhappen, Kjphill1977, Brickproduction1815, Murfski, Cornerss, 3primetime3, Jahmez, Jacob Gotts, WikiEditorial101, Eurodyne, Searching for the truth on the web, Batdaniele, Tamblambe1991, GunnersXP, Jerodlycett, John-el-titor-2036, Oluwa2Chainz, ProprioMe OW, Wernstrom, Pleiadians11, Marieisnotonfire, Allthefoxes, InternetArchiveBot, GreenC bot, Dad of 3 ls, Theorist 1331, Highly Ridiculous, Innovr3, Wikishovel, Yeet5664 and Anonymous: 1052

- **Juvenilia** *Source:* <https://en.wikipedia.org/wiki/Juvenilia?oldid=774786435> *Contributors:* Phthoggos, Rich Farmbrough, FlaBot, Axver, Bhny, RL0919, Mholland, Chrishmt0423, Rdhs100, SmackBot, Can't sleep, clown will eat me, Rob-enwiki, Cydebot, Shirt58, Celithemis, Froide, Julianelpiki42, Lou.weird, Lethesl, 703Frank, Editor510, Bellwether BC, Addbot, Luckas-bot, AnomieBOT, Llyntegid, Aus-sisu, Omnipaedista, Erik9bot, Татьяна Маховицкая, Don512ria, ZéroBot, ClueBot NG, TruPepitoM, Brainercricket, KLBot2, Marco-capelle, WOLF LAMBERT, Marquis Cha-Cha, TheBawbb, Scultzsinos and Anonymous: 14
- **Kinetic bombardment** *Source:* https://en.wikipedia.org/wiki/Kinetic_bombardment?oldid=781390165 *Contributors:* Bryan Derksen, Edward, Ubiquity, Patrick, Michael Hardy, Axrosen, Emperor, Rossami, Populus, Finlay McWalter, Ukuk-enwiki, Auric, Vftrickey, Cyberia23, Lproven, Gracefool, Bobblewik, John Abbe, Bri, Vsmith, MeltBanana, Waxwing slain, TomStar81, Giraffedata, Hu, Wtmitchell, Admiral Valdemar, Recury, LukeSurl, KTC, Skorgu, Joelfr, HolgerDK, Hbobbrien, Rjwilmsi, Coemgenus, Eyu100, Quiddity, Miserlou, Yar Kramer, Eubot, Gurch, Kolbasz, Scoo, Ahpook, Straker, Arado, Episiarch, Epolk, Scott5834, Hydrargyrum, David Woodward, ENeville, Shepazu, MakeChooChooGoNow, Karl Andrews, Nikkimaria, Arthur Rubin, Fang Aili, Sturmovik, Cffrost, Fouroufour, Borisbaran, MaeseLeon, SmackBot, Francisco Valverde, Septegram, Masklinn, Chris the speller, Bluebot, Thumperward, Neofaun, Hibernian, Dr. Crash, Hmoul, Khazar, J 1982, Therealhzal, TheFarix, Ossipewsk, Scarlet Lioness, CmdrObot, Washi, Kubanczyk, Zanelatta, Chronolegion, The Berzerk Dragon, J mur, Erock23, Uriah is Boss, Venrix, Ariel., Kiore, CommonsDelinker, KTo288, Loren Pechtcl, OttoMäkelä, Nanoforge, Fernando Estel, Oconnor663, Imasleepviking, Calbookaddict, Ilyushka88, Spiral5800, Meters, Jack Merridew, Oldag07, Egloskerry, EoGuy, Wraithful, Mild Bill Hiccup, Auntof6, Kitsunegami, Addbot, Miskaton, Nohomers48, Jad4400-enwiki, Anthraxgoon, 84user, Tide rolls, BlackMarlin, Legobot, Yobot, Wikipedian2, AnomieBOT, Krelnik, MaterialsScientist, Cchj768, Oluiies, Slayer621, FrescoBot, TiroGrande, Serols, EasyEight, Onel5969, RobertAlanHarris, EmausBot, John of Reading, Doelleri, John Cline, MPrime, Myth318, Wingman417, ClueBot NG, Regulov, BG19bot, Pblase42, Dan653, Hasdi, Josh p75, TheGoodBadWorst, Iqbal-baig.iitm, Fraulein451, Arcandam, 602p, Z07x10, Madreterra, Yawline, Kennethaw88, Stolitsa740, FockeWulf FW 190, MjolinrPants, Benjamin "Jeffrey" Powell, Ticatic10, Firefly4251, Twistednuke, BicePhD, MinorStoop, Tralala0, Babymisfortune, Fruitloops24, Ops16, HarryKernow, 200124Peter, EnderDovahkiin, GaryColemanVelociraptor, SkyFactoids, Bender the Bot, Stoneman85 and Anonymous: 233
- **KISS principle** *Source:* https://en.wikipedia.org/wiki/KISS_principle?oldid=783002387 *Contributors:* Zundark, Eclecticology, Patrick, Tim Starling, MartinHarper, Delirium, Angela, Evercat, Mxn, Emperorbma, Bemoeial, David Latapie, Jay, Marshman, David Shay, Samsara, Khym Chanur, Wiwaxia, Sjordford, Chealer, Bisolo, Cyrius, Matflaschen, Pengo, Dina, Kim Bruning, Sukoshisumo, Peruvian-llama, Jorge Stolfi, Khalid hassani, Edcolins, Andycjp, DocSigma, Fuzzy Logic, I am sexy, Dsandler, Darksun, Ropers, Neuromancien, Robin klein, Zondor, Lubaf, Discospinster, Francis Schonken, Fluzwup, Tavkheldzem, Project2501a, Ben Webber, Spalding, Circeus, MaxHund, Pharos, Lysdexia, Anthony Appleyard, Elpincha, Atlant, Jezmck, Curious1i, Evil Monkey, Drbreznjev, Dismas, Buttered-Toad, Feezo, Star Trek Man, Fred J, MFH, Akavel-enwiki, Tokok, Wisq, Karam.Anthony.K, VerballyInsane, Graham87, Kbdank71, Reiso, Yug, Yamamoto Ichiro, Kri, King of Hearts, Chobot, YurikBot, Wavelength, Cyberguy34000, Pi Delpot, YoavShapira, Manop, Gaius Cornelius, Ksyrie, Mundlapati, Horncomposer, NawlinWiki, Nirvana2013, Neutron, Lexicon, BOT-Superzerocool, Bota47, Hakeem.gadi, Doncram, Ms2ger, Pawylee, Light current, Shinhan, Moogsi, Jecowa, DearPrudence, SmackBot, PaulSinnema, Elindstr, Rtc, McGeddon, DanielPenfield, Cachedio, Gilliam, Squashy, EncMstr, CSWarren, Colonies Chris, Antonrojo, Darth Panda, John Reaves, Warpling, Alieseraj, Charlieb63, Normxxx, Cybercobra, Richard001, Nutschig, Kirils, Matt.forestpath, Sturman, ResearchRyan, Mborg, BrotherFlounder, Wikipedical, FlyHigh, Pecisk, Hkkbs, Spiritia, Dono, Gennaro Prota, Kuru, Gobonobo, Knshaum, InedibleHulk, Waggars, Kiamlaluno, Citicat, Wwagner, Lee Carre, Laitr Keiows, Haus, Rangi42, FatalError, Zarex, Punanimal, Dperiwal, Dgw, ShelfSkewed, Arrataz, Scofield Boy, MC10, Gogo Dodo, Travelbird, Minfo, Underpants, TheJC, Rocket000, Fyedernogger-snodden, JoeHolloway, Thijs!bot, LGReed, Wikid77, Monsieur champs, Nm pereira, HappyInGeneral, Andyjsmith, Rferreira, Silver Edge, Escarbot, Mentifisto, Seaphoto, AlgorithMan, Dylan Lake, Perakhantu, Barek, Pcubbage, BCube, Xeno, Moralist, Wasell, Repku, Magioladitis, FabrizioMarana, Jatkis, R0m23, Make, Damuna, Oicumayberight, MartinBot, Aladdin Sane, Felipe1982, Herbythyme, Suviljan, AntiSpamBot, SJP, Robertgreer, Dhuluza, Remember the dot, Considine, Hulten, Vranak, 28bytes, ABF, The Wild Falcon, Amikake3, PGSONIC, Dfcamara, Technopat, Gogreen11, Don4of4, Discgolfrules, Drbigric, SieBot, Amourfou, DarknessEnthroned, MikeGogulski, Mr Taz, Jrn, Mar(c), Flyer22 Reborn, Tobibeer, Tomek.poznan, WacoJacko, Legionarius, HighInBC, HaploTR, Abmcdonald, Walrmund, Asher196, Fredmdub, ClueBot, Ndenison, Silent Key, Wildspell, SuurMyy, Diegowarrior, Drawn Some, 7&6=thirteen, Courthead, Dank, DumZiBoT, Lsoares, Karnorthernstar, PSWG1920, TehSpud, Mm40, Addbot, Wadewilliams, Annieologue, Pubwvj, Debresser, Zorrobot, Jarble, Ben Ben, Legobot, Luckas-bot, Yobot, Crispmuncher, Washburnmav, Sarrus, 4th-otaku, Jlahteen, AnomieBOT, Clarinetguy097, Afattah, MaterialsScientist, Moljac024, Xqbot, Jonathan321, Intelati, GenQuest, Ilike-cats=D, Thehelpfulbot, FrescoBot, Xophist, Momergil, Carlopries-enwiki, Jusses2, Hoo man, RedBot, Lotje, Michael9422, Dj sardaukar,

EmausBot, Sirslacker, Gfoley4, Bua333, Slightsmile, Gottogog, ZéroBot, NikitaUtui, Donner60, Denholm Reynholm, Zyrady1, Adbge, Rocketrod1960, Lonestarl101, Mikhail Ryazanov, ClueBot NG, KeepItSimpleCOM, Helpful Pixie Bot, Wbm1058, Jokerdino, AvocadoBot, Daniel0071~enwiki, Euphoria42, Gwalleit, David.moreno72, DarafshBot, Aurelien.d, ChrisGualtieri, Ducknish, Harsh 2580, B0bthesheep123, Gnarlycs, For the leg, Myconix, Mwoc87, Getpeaceown, DefinitionWizard, Jsthib, Bad Dryer, StudiesWorld, Queder, WikiOriginal-9, Gronk Oz, Ggmmaxrpm, Andrew pfeiffer, Narky Blert, Riccardo33, Mediandartists, Some Gadget Geek, ShelleyHorwitz, Golden Dalek, Mckburton, UnequivocalAmbivalence, Tayhaithian, GSS-1987, RobbieIanMorrison, Bender the Bot and Anonymous: 297

- **Knock-and-announce** *Source:* <https://en.wikipedia.org/wiki/Knock-and-announce?oldid=781939460> *Contributors:* Ed Poor, DocWatson42, Neutrality, Causa sui, PullUpYourSocks, Richard Arthur Norton (1958-), Ender78, Jersyko, GregorB, BD2412, Yamamoto Ichiro, SchuminWeb, Assawyer, GodSka, SmackBot, Mauls, Qwasty, Robofish, Notecardforfree, Wiendietry~enwiki, Mwils024, Seresin, Trickshot11, Rosuav, Cirt, RKill, Addbot, AnomieBOT, Max conformist, Fruvous, FrescoBot, Tanner Swett, Dekker451, Ο ὁ ἴστρος, Battlesnake1, Lord Monbodd0 and Anonymous: 13
- **LANTIRN** *Source:* <https://en.wikipedia.org/wiki/LANTIRN?oldid=779553566> *Contributors:* Jrshaw, Sertrel, Riddley, Bobblewik, H1523702, Pmsyzz, Rama, ArgentLA, Dan100, CruiserBob, Nvinen, Ketiltrout, FlaBot, Arado, BOT-Superzerocool, Emijrp, SmackBot, Chris the speller, Dual Freq, A.R., Joffeloff, Scetoaux, Nfutvol, Hagman1983, CmdrObot, Cydebot, Gogo Dodo, Benvogel, NDCompuGeek, Thijs!bot, Dogaroon, Gh5046, Taylorm7, R'n'B, Ndunruh, VolkovBot, CWii, HJ32, IHTFP, Rett Mikhal, Gillyweed, Perfectapproach, Kbwjr82, PixelBot, Pataramyra, Dave1185, Addbot, Tempdick, Tcnv, Lightbot, Luckas-bot, AadaamS, Yobot, AnomieBOT, Jim1138, Tokyotown8, Haltendehand, HJ108, Agsftw, Sp33dyphil, GianniG46, BarrelProof, 北京人在悉尼, Cyberbot II, F111ECM, SantoshBot, MPS1992, InternetArchiveBot, Bear-rings and Anonymous: 46
- **Last meal** *Source:* https://en.wikipedia.org/wiki/Last_meal?oldid=782019729 *Contributors:* Delirium, Rossami, RickK, WhisperToMe, Raul654, Chrism, Academic Challenger, Cholling, Auric, Mushroom, Seth Ilys, Peoplesyak, Mboverload, Richard K. Carson, CJCurie, Ellsworth, TiMike, Ensrifraff, Shadowlink1014, Tomwalden, Fg2, D6, Ocon, Dpm64, Randee15, Ardonik, Paul August, Zeno-hockey, Summer Song, Aude, Ludek9, Escarole, Ricky81682, Svartalf, Evil Monkey, BDD, Czolgol, Angr, David Foster, Nugget-boy, Gimbo13, Gettingtoit, Graham87, Josh Parris, Pentawing, Rjwilmsi, Quiddity, ElKeybo, Ground Zero, Intersofia, NekoDae-mon, Jamesfisher, IgorMagic, Preslethe, Fct, Imnotminkus, Agamemnon2, Gardar Rurak, Killridemedly, The JumpStation, Bloodofox, Mistrmind, Lexicon, Gregg02, Kingpomba, Julienlecomte, Syrthiss, Lockesdonkey, Asarelah, Aidanb, Schnauf, Sandstein, TheMad-Baron, Closedmouth, FyzixFighter, Mr. ATOZ, SmackBot, Nahald, Brian1979, David Kernow, Hanchi, Mikecraig, Xaosflux, Gilliam, Richfife, Teodorico, Sadads, Namangwari, MaxSem, Jahiegel, Awh, MattShepherd, EOZyo, Xyzzyplugh, Chrylis, Blackmesa, Astroview120mm, TheListUpdater, Ohconfucius, Luigi-ish, Ben Jos, Avodaemon, Dilcoe, A. Parrot, Jwcabill, DI2000, Deanh, Shoeofdeath, Blackhawk charlie2003, Muhand, KimChee, Angeldeb82, Bubbha, Tanthalas39, Matthew Auger, HalJor, TenthEagle, Blindman shady, Rsage, N5iln, Anupam, Iulius, NjtoTX, F-451, Hoponpop69, Storkk, MeowthRocket, Postcard Cathy, Gavia immer, Diggoryvenn, Mewtowwimmer, VoABot II, Froid, Markoff Chaney, KConWiki, MetsBot, Romancer, Ztobor, Drewmutt, Bus stop, Khurg100, Stolen Halo, Veriss1, Plasticup, Uhai, WWGB, Wikimanpedia, Beta7, Jorge MG, MAKAVELI x87x, Kaiketsu, January2007, PeRiDoTs13, Ecopetition, Monty845, Doc James, Ohiostandard, SieBot, Griefehate, TheEvilDildo, Flyer22 Reborn, Phoneclear, Green-eyed girl, Monobeg, Mygerardromance, Angel caboodle, ClueBot, Billwilson5060, Postmortemjapan, Jan1nad, Niceguyedc, Ansh666, Rockfang, Morphius1403, NuclearWarfare, Zdravljica, TrulsR, CowboySpartan, Mlaffs, Another Believer, Icanhazbear, Carlson288, Wxkat, XLinkBot, Netrat, Doc9871, Badgernet, EEng, MatthewVanitas, Addbot, Friginator, Neodop, LilliCat, Xtalcy, John Doe 1346, OIEnglish, Luckas Blade, Zorrobot, Jarble, Coviepresb1647, Yobot, Reenem, AnomieBOT, Faethon Ghost, Metalhead94, Unknowntheast, Bluerasberry, Materialsscientist, Citation bot, Williamsburgland, Belasted, JimVC3, Nasnema, Lunaticneko, Prezbo, Green Cardamom, Ace of Spades, Girlwithgreeneyes, Pinethicket, Jonesey95, Jon6666, Full-date unlinking bot, Radar1100, Lotje, Comet Tuttle, Begoon, Rtrtrt, Mean as custard, RjwilmsiBot, Perspeculum, Acather96, InvisibleBacon, Kirsion, Sepguilherme, ZéroBot, Dngrogan, H3llBot, Wayne Slam, ChuispastonBot, Erikrood20, ClueBot NG, WIERDGREENMAN, Battlesnake1, Thisbites, Joefromrandb, Alpha7248, Widr, Guy-HimGuy, Not with all those rocks about, Helpful Pixie Bot, Newyork1501, BG19bot, MasterMind5991, TeeVeed, Northamerica1000, MusikAnimal, Catquayle, Daleymoe, Cafolizza, RCPryor, BatonRougeNXG, BattyBot, Qbli2mHd, David.moreno72, ChrisGualtieri, ZappaOMati, Khazar2, Ducknish, Futurist110, FoCuSandLeArN, Hendeertel, Lugia2453, AldezD, Me, Myself, and I are Here, TheFrog001, Jamescmahon0, Just searching77, Melonkelon, Backendgaming, DavidLeighEllis, Mrhumphrey1s, Robevans123, HYH.124, Matv201, Monkb0t, GlennByrnes6, Tpistoia, Sdc3000, Esquivalence, Sundayclose, Daddyman1962, ChemWarfare, Sunshine State 2015, MB, Bosley John Bosley, InternetArchiveBot, Debbiesw, GreenC bot, Bender the Bot, Chiefbubba, Eralt94, SammyMajed and Anonymous: 367
- **Law of Jante** *Source:* https://en.wikipedia.org/wiki/Law_of_Jante?oldid=780162135 *Contributors:* Sjc, Infrogmation, Michael Hardy, Gabbe, Mic, Chrm, Haabet, Charles Matthews, Peregrine981, HippieTrail, Rasmus Faber, Agendum, Xyzzyva, Rossrs, Loui Da Boss, Andycjp, Kate, Haggen Kennedy, Byrial, Pavel Vozenilek, Mulder1982, Kwamikagami, Leifern, Eddideigel, Ranveig, Orzetto, Jeltz, Apoc2400, CJ, SidP, Computerjoe, Richard Arthur Norton (1958-), Woohookitty, Jacen Aratan, Twthmoses, Preisler, SDC, Graham87, JørgenM, Rjwilmsi, Sallemann, Jax-wp, Airunp, YurikBot, Mycos, Gustavb, MX44, Froth, Bucketsofg, Nescio, Rallette, SmackBot, Unyoyega, Spag85, Ohnoitsjamie, 32X, Philwino, Onceler, Cloud02, Meco, Joseph Solis in Australia, Solipse, Zarex, Lentower, Devanatha, Thijs!bot, JAndbot, Narssarsuaq, Max Hyre, Berig, JMyrleFuller, Sasper, R'n'B, Bothnia, Idioma-bot, The Duke of Waltham, Frailisthehuman, AlleborgoBot, SieBot, LKNUTZ, Bigdaddy1981, ThorHammer17, Blanche Poubelle, Saddhiyama, SuperHamster, Excirial, Nymf, Njardarlogar, PenfoldNorway, Addbot, Mbinebri, Lightbot, OIEnglish, Luckas-bot, Yobot, Legobot II, Nederbörd~enwiki, AnomieBOT, ArthurBot, Anonymous from the 21st century, Omnipaedia, Hushpuckena, Lundgren8, I dream of horses, Jandalhandler, SergeWoodzing, Hisham saadi, Standardfact, OnWikiNo, AlanSiegrist, Hurven, Wingman417, Gri3720, Gunnar345, ClueBot NG, Jack Greenmaven, Jens2010, Kristo1410, Iselilja, Jsk10, MeanMotherJr, YFdyh-bot, Isarra (HG), YapsCarrot, ArmbrustBot, Mvhaha, Jianhui67, Kelaer, Julietdeltalima, Johannesmikkola111, Equinox, Gamren and Anonymous: 136
- **Leftovers** *Source:* <https://en.wikipedia.org/wiki/Leftovers?oldid=778378334> *Contributors:* Alan De Smet, Xanzzibar, Dmmaus, Chowbok, Andycjp, Alexf, Dr.frog, Rich Farmbrough, El C, Wiki-uk, Killing Vector, Dismas, Vegaswikian, Loggie, Huw Powell, Badagnani, Plhofmei, Esprit15d, GraemeL, SmackBot, Mangoe, Agentba, Unforgettableid, Jushi, Chris the speller, Wintersweet, Mighty-pawn, 16@r, Gveret Tered, Winston Spencer, Cydebot, Hydraton31, Tpchai, TAnthony, Nyttend, NewEnglandYankee, Rebent, Mirrage GSM, Redtigerxyz, VolkovBot, Leeb0, Gune, SelketBot, Ng.j, Falcon8765, SieBot, Happsailor, Flyer22 Reborn, Umbrasquall, Wtp512, Dravecky, Karl2620, BrianV2, ClueBot, Alexbot, 7&6-thirteen, XLinkBot, Annachie, Dnrvantj, Addbot, Snyder9898, Hsl9494, Komischn, Yobot, FFEFD5, AnomieBOT, Diádoco, Bluerasberry, Fredde 99, Darrenaustalia, Tad Lincoln, Locobot, FrescoBot, Citation bot 1, Jo.Fruechtnicht, BaSH PR0MPT, Erianna, Mayur, Will Beback Auto, Woottonjames, ClueBot NG, Foodinitaly, Northamerica1000, Gates of Ale, BattyBot, Hali1024, SamoaBot, NameetSurana, Kidsrock5454, Nøkkenbuer, Equinox, Sunil The Mongoose, GreenC bot and Anonymous: 61

- Lesser Key of Solomon** *Source:* https://en.wikipedia.org/wiki/Lesser_Key_of_Solomon?oldid=780744885 *Contributors:* Bryan Derksen, Michael Hardy, Angela, Goblin, Charles Matthews, The Warlock, Rursus, DocWatson42, Djinn112, Ferkelparade, Quadell, Gary D, MakeRocketGoNow, Discospinster, Auto movil, Dbachmann, Sunborn, Irishpunktom, BDD, RHaworth, Marudubshinki, L-Zwei, Dwarf Kirlston, Search4Lancer, FlaBot, RobertG, Mordicai, YurikBot, Butsuri, Rtkat3, 999~enwiki, Mark Ironie, Wiki alf, Elix3r, Banana04131, SmackBot, Elonka, Reverend Duck, Roberto Cruz, Canonblack, ERcheck, Bluebot, Apeloverage, Chaoscrowley, Colonies Chris, Clinkophonist, KI, Germandemat, Easyboy82~enwiki, Armadel, Ryulong, Edman~enwiki, Cydebot, Synergy, Frater5, Ebyabe, Casliber, Widefox, JAnDbot, Magioladitis, Kim Dent-Brown, ***Ria777, Nigholith, Ian.thomson, Achnash, Useight, VolkovBot, TXiKi-BoT, Java7837, IPSOS, Doug, Elcalen, New Babylon 2, RozzWilliams, Cozret, Randy Kryn, Lmateo002, Niceguyedc, Arsgoetia, Alexbot, Goeticgirl, Lolerkon, ScribeMaster, SoxBot, SchreiberBike, El bot de la dieta, Alsophocus~enwiki, Jytdog, Avoided, Will in China, Aunt Entropy, Good Olfactory, Addbot, Deus257, Fieldday-sunday, Lightbot, OIEnglish, PlankBot, Luckas~bot, Yobot, AnomieBOT, Obersachsebot, Xqbot, Musicguyguy, Almabot, J04n, Omnipaedista, SonicScrew, DenisKrivosheev, Haeinous, Rodneyorpheus, Louperibot, HobgoblinOfLittleMinds, The Cobwebs and the Sorrow, Lotje, Edwardo Edita, Tbhotch, Darkflame9, John of Reading, Secret ant, Ida Shaw, Lillith's truth, ClueBot NG, Solomoniegolem, ScottSteiner, Trickae, François de Commynes, Helpful Pixie Bot, Jeraphine Gryphon, BG19bot, Majectics73, Starlight666, BayushiKazemi, H. 217.83, Balaster32, Vladis13, Thang L.D.Q., JudeccaXIII, Bitmaster, DeMediFamilyGodfather, God's Godzilla and Anonymous: 89
- Limited hangout** *Source:* https://en.wikipedia.org/wiki/Limited_hangout?oldid=764675193 *Contributors:* Bueller 007, PermanentE, Bender235, Closeapple, Rajah, John Quiggin, Stefanomione, Ronnotel, Michael Slone, Hydrargyrum, Stephenb, SMcCandlish, Groyolo, SmackBot, Ratarsed, McGeddon, Nfgii, Bluebot, Mgiganteus1, Levineps, CmdrObot, GargoyleMT, Location, Cydebot, MarshBot, RobJ1981, Caesarjbsquitti, Gwern, R'n'B, J496, Georgi Plekhanov, Dthomsen8, ContiAWB, AnomieBOT, TPaineTX, Omnipaedista, RjwilmsiBot, Yt95, JohnValeron, BG19bot, Mark Arsten, Teachingaway, Me, Myself, and I are Here, IICorso, Kent Krupa, Bender the Bot and Anonymous: 23
- Limonana** *Source:* <https://en.wikipedia.org/wiki/Limonana?oldid=780589168> *Contributors:* Billposer, Klemen Kocjancic, Smalljim, Jérôme, Woohookitty, BD2412, Koavf, DVdm, Anomalocaris, Yoninah, Gilabrand, Cydebot, Magioladitis, Kimse, Malik Shabazz, Denisarona, Jobas, Chefallen, Berean Hunter, Addbot, Abjikkam, Yobot, AnomieBOT, عبيد المؤمن, Supreme Deliciousness, Hanthala~enwiki, Swampgator94, Northamerica1000, Monkbob, Guyc1999, عمار الدين المقدسي, Byutiful Kampus, Nobilk, Jmc76, InternetArchiveBot and Anonymous: 34
- Lingchi** *Source:* <https://en.wikipedia.org/wiki/Lingchi?oldid=782285639> *Contributors:* AxelBoldt, Bryan Derksen, The Anome, William Avery, SimonP, Maury Markowitz, Dante Alighieri, CatherineMunro, Emperor, Julesd, Jiang, Uyanga, Denny, Charles Matthews, Vanished user Szariu3jisj0j4irj, WhisperToMe, Zoicon5, Cmholm, Gak, RedWolf, Donreed, Lowellian, Texture, Paul Murray, Céréales Killer, Fennec, Ferkelparade, Zigger, Everyking, Varlaam, Gugganij, Confuzion, DavidBrooks, Tyler McHenry, Shadowlink1014, Klemen Kocjancic, WikiDon, Gest, CALR, Clouseau, Rich Farmbrough, Sladen, Bender235, Jgrosch, Johannes Rohr, Brian0918, Patrickov, CanisRufus, FirstPrinciples, Whosyourjudas, Cmdrjameson, BillyTFried, Agnamaracs, Rolfmueller, Gothicform, Anthony Appleyard, SnowFire, Glaurung, Peter McGinley, Ghirlandajo, Dan100, Kay Dekker, Bacteria, Woohookitty, GVOLTT, CWH, Splintax, Fred J, Oldie~enwiki, とある白い猫, BD2412, Charmii, Dpr, Josh Parris, Rjwilmsi, XP1, Gurch, CiaPan, Chobot, Ravenswing, RussBot, Gaius Cornelius, Xersta, NawlinWiki, Lao Wai, Moe Epsilon, Kyle Barbour, Qrfqr, Zzuuzz, Thursiya, Arthur Rubin, Jennings.e, Willbyr, DisambigBot, Fastifex, Groyolo, SmackBot, Dweller, Ze miguel, Lds, Portillo, Carambola, Chris the speller, Bliz, Thumperward, DHNbot~enwiki, Oatmeal batman, George Ho, Seduisant, Isonomia, Underbar dk, TechPurism, Derek R Bullamore, KeithB, ElizabethFong, Ohconfucius, Nishkid64, Ser Amantio di Nicolao, Dbtfz, John, Gnevin, UKER, Peyre, Tyhopho, Atakdoug, Stephen B Streater, Iridescent, Guss2, CRGreathouse, CmdrObot, Amalas, Johnlogic, Typewritten, Cydebot, Xihe, Mtpt, NDCompuGeek, Nugneant, Thijs!bot, Biruitorul, Smjc, Esowteric, JustAGal, GideonF, Niohe, Dalliance, Widefox, SummerPhD, Reishidave, Reshmasanyal, Bobke, Qwerty Binary, Sam 1123, Sheitan, Hno3, Olwak, VoABot II, Nyttent, Destynova, RogerGravel, Philg88, Kayau, Neilwavg, OPen2737, KTo288, Erkan Yilmaz, Anglo-Norman, Igno2, Gurchzilla, Atama, Geekdiva, Frer3, VolkovBot, Joopercoopers, P3nabad, The Mink Ermine Fox, Andreas Kaganov, Feudonym, Eve Teschlemacher, Cmcnicoll, Doc James, Trigaranus, Rédacteur Tibet, Mimihitam, Filam3nt, Dfalao, Tapir666, Altzinn, Tiny plastic Grey Knight, Ainlina, Martarius, Sudheerulz, Wikievil666, Cmax205, EoGuy, Philosophy.dude, Jdb00, Lorenzen6, Niceguyedc, Boneyard90, Ktr101, Jusdafax, OnTheMantle, Doprendek, Botang, DumZiBoT, MystBot, Tar-ba-gan, Radh, Felix Folio Secundus, Asrghasrhiojadrhr, Addbot, Barsoomian, Tassedethe, Lightbot, OIEnglish, Luckas~bot, Yobot, Ptboutgourou, Kipoc, PMLawrence, Gongshow, Greg Holden 08, AnomieBOT, Jim1138, Quebec99, DSisyphBot, Alvin Seville, White whirlwind, Edward130603, Toby72, Dhtwiki, MarB4, Loyalist Cannons, Fixer88, HRW in 1899, DReifGalaxyM31, LilyKitty, 777sms, ZhBot, RjwilmsiBot, Ripchip Bot, Nivekin, Immunize, K.eight.a, Abw1989, Penom, Solomonfromfinland, ZéroBot, Sundostund, DPS145192, Tono Fonseca, 14kparrett, Huodaxia, Player-23, Tolly4bolly, ChuispastonBot, Limxzero, ClueBot NG, Joefromrandb, Kamek98, Delusion23, Primergrey, Widr, Punchomatic, Calabe1992, Viril2000, Lo Ximiendo, Mediation4u, Shujenchang, Cyberbot II, Rajmaan, Lgfd, CCH1234, Comp.arch, LukusArelius, Jade Phoenix Pence, Captain Cornwall, Monkbob, Esiymbro, Kartoffelsalat275, Rubbish computer, Crito10, InternetArchiveBot, GreenC bot and Anonymous: 197
- List of diseases of the honey bee** *Source:* https://en.wikipedia.org/wiki/List_of_diseases_of_the_honey_bee?oldid=781849074 *Contributors:* Josh Grosse, Fubar Obfusco, Heron, JDG, JohnOwens, Rossami, Emperorbma, Wik, Pollinator, Sjordford, Korath, Altenmann, Chris Roy, Saforrest, Mattflaschen, Alan Liefing, Rick Block, Leonard G., Bobblewik, Golbez, PDH, Sam Hocevar, Vertigo~enwiki, Bri, Rich Farmbrough, LeeHunter, Ground, Elwikipedista~enwiki, Iamunknwon, Stesmo, Pokrajac, Alansohn, Fawcett5, Avenue, Shoeffly, Gene Nygaard, LOL, PoccilScript, Benbest, Jeff3000, Graham87, Cuvtixo, Rjwilmsi, Rheone, Consumed Crustacean, Srleffler, Conscious, DogGunn, Epolk, Gaius Cornelius, Spike Wilbury, Malcolm, Larsinio, JHCAufield, Smkolins, Le sacre, JLaTondre, SmackBot, Espresso Addict, Bluebot, RDBrown, Stephanvaningen, Tonica, Frap, Goetter, Friendlyliz, DinosaursLoveExistence, Just plain Bill, GameKeeper, Tmchk, Kuru, Rkmlai, Beno1000, CBM, Richard Keatinge, Dyanega, Saimhe, Blue Tie, Will Sanders, JAnDbot, NE2, Gwaith, Magioladitis, Just James, Gandydancer, MikePhobos~enwiki, R'n'B, Kateshortforbob, CommonsDelinker, Filll, Mwils014, Jevansen, Jrmgkia, Maf5081, DrMicro, ICE77, TXiKiBoT, James Baraldi, Jr., 2112 rush, VanBuren, AlleborgoBot, SieBot, Keilana, Cult of the Sacred Or nge, DrippingGoofball, Dillard421, Anchor Link Bot, The Thing That Should Not Be, Crywalt, Hans Adler, Trigley, Ost316, ZooFari, Addbot, Lightbot, Lachie22, Yobot, II MusLiM HyBRiD II, AnomieBOT, Jim1138, MaterialsScientist, Citation bot, OllieFury, LilHelpa, Bugboy52.40, Gigemag76, Shattered Gnome, Dan6hell66, Josef Papi, FrescoBot, Citation bot 4, DrilBot, Serols, Jandalhandler, Trappist the monk, Silent Billy, Jonkerz, Miracle Pen, Yangosplat222, Brian Fishback, Dcirovic, H3lIBot, Suslindisambiguator, Tiganusi, Haliaetus1340, Biosicherheit, Chester Markel, Korrawit, ErinPilgrim, BG19bot, PhnomPencil, NotWith, Entomologger, BattyBot, Cyberbot II, TylerDurdens8823, The Quirky Kitty, ComfyKem, Me, Myself, and I are Here, Kgadams93, Eva Forsgren (SLU), Joachim de Miranda (SLU), Molestratus, Juhuyuta, EMWestcott, Beeguy80, Monkbob, Kangsar, Guidocordoni, Amyfarid1, Nkbmb, InternetArchiveBot, GreenC bot, Bender the Bot and Anonymous: 107

- **List of intelligence gathering disciplines** *Source:* https://en.wikipedia.org/wiki/List_of_intelligence_gathering_disciplines?oldid=741041290 *Contributors:* SimonP, Stevertigo, Isomorphic, DocWatson42, Rj, ArnoldReinhold, Hooperbloob, Stefanomione, Mrtoodles, WAS 4.250, Blakis, A.R., CmdrObot, Bridesmill, Cydebot, Hcbkowitz, Lperez2029, YaZug, Wxhat1, Jeepday, Aesopos, Ask123, LanceBarber, @pple, Pjof, XLinkBot, Richard-of-Earth, Galoubet, FrescoBot, Stark0311, Staszek Lem, Catlemur, Dainomite, ChrisGualtieri, Dextbot, KBH96, Danica J Kretschmann, Invisible Guy, Slimjoe1 and Anonymous: 22
- **Living creatures (Bible)** *Source:* [https://en.wikipedia.org/wiki/Living_creatures_\(Bible\)?oldid=777217410](https://en.wikipedia.org/wiki/Living_creatures_(Bible)?oldid=777217410) *Contributors:* Bryan Derksen, Michael Hardy, RickK, AnonMoos, Hayyoth, MPerel, Alansohn, Simetrical, Crzrussian, SpectrumDT, Valentinian, Daniel575, SmackBot, Buchanan-Hermit, Mihirgk, Gco, Shirahadasha, ShelfSkewed, Dadofsam, Doug Weller, Alaibot, Eliyyahu, Aristox, Feyenatic london, Theroadislong, Zahakiel, KazakhPol, Ian.thomson, Johnbod, Jasonasosa, Mrg3105, Java7837, StAnselm, Fadesga, TTY, Kathleen.wright5, Editor2020, Addbot, דביר, AnomieBOT, SlothMcCarty, Omnipaedista, I dream of horses, In icu oculi, Ben Ammi, Oursana, Telpardec, JohnThorne, Hmainsbot1, Budro6, Markseasigh, Bender the Bot and Anonymous: 22
- **Lost, mislaid, and abandoned property** *Source:* https://en.wikipedia.org/wiki/Lost%2C_mislaid%2C_and_abandoned_property?oldid=775355301 *Contributors:* Ed Poor, PaulinSaudi, Denelson83, Wereon, Xanzzibar, BozMo, Beland, Zbd, Francis Davey, Art LaPella, Tetromino, ClockworkSoul, LordAmeth, PullUpYourSocks, Jergen, BD2412, DDerby, Wavelength, Aekolman, Anomalocaris, Jacklee, Sardanaphalus, SmackBot, Mauls, Gilliam, Quidam65, Ohnoitsjamie, Parajuris, Catchpole, A. B., Kuru, Tony1343, ג'ניאל 293.xx.xxx.xx, Eastlaw, KnightLago, Thijs!bot, Ultimus, Uruiamme, Majorly, Themadman, Carlwev, Nyttend, JaGa, Ebonn, Swieland, Black-rabbit, McSly, Kugel-enwiki, RJASE1, Seattle Skier, Steven J. Anderson, Raymondwin, Joseph A. Spadaro, Cjahunter, Tpb, A E Francis, Prgyu72, ClueBot, Sdfoasfj12987234, Splasher3005, Tmcarlsonmn, Ttdenning, Cryptk, XLinkBot, Addbot, Mankash, AnomieBOT, Rubinbot, Asrtout08, Thehelpfulbot, FrescoBot, Umrs, Maverick9711, BenzolBot, Scientific29, PrincessWortheverything, Blixon, Root4ducks, SD5bot, Hmainsbot1, Bigdarell, Erudite Manatee and Anonymous: 47
- **Lovers rock** *Source:* https://en.wikipedia.org/wiki/Lovers_rock?oldid=765063087 *Contributors:* Zoe, Stevertigo, TUF-KAT, Furrykef, Hyacinth, Secretlondon, TheParanoidOne, Walter Görlitz, Sun King, Bastin, Woohookitty, John Eden, Cod, Teklund, Lairor, RobertG, Nihiltres, Theelf29, GeeJo, Ezeu, Rwalker, Pegship, Mais oui!, Eaeftremov, Sardanaphalus, Derek R Bullamore, Popstock, Iridescent, Cydebot, 17Drew, Dniezing, BlueSquadronRaven, MER-C, Michig, Beaumont, BR64, BlueLotusLK, Cgilbert76, Jeepday, Sixpacz, Egghead06, TXiKiBoT, WatchAndObserve, Ridernyc, McM.bot, IL7Soulhunter, Sassyy, Heimm Old, Nite-Sirk, Blackjays1, Flyer22 Reborn, GIRO61, Caspiax, ClueBot, Gene93k, Roots2k, Dorkinglad, Redrovers, Niceguyedc, Alexbot, Mikaey, Beshara (Band), WikHead, Addbot, Jafeluv, Socheid, Tassedethe, Lightbot, Nagasheus, AnomieBOT, Yanelekssklus, Copyrightmanager, Xqbot, Millelax, Sabrebd, Launchbottle, Cwilliams, Tshotch, Hiddenstranger, John of Reading, GoingBatty, ZéroBot, Midas02, Zuky79, ClueBot NG, CactusBot, Proscribe, BG19bot, Benzband, Sheerclass, Khazar2, Gentlecollapse6, BDE1982, Abrightly, Mawscope, Supevan, Savvy-jack23, Jakob9999, Liv21, MrDiaspora2014, Kalope, Imasamba, Socapro, Justeditingtoday and Anonymous: 65
- **Magnetism** *Source:* <https://en.wikipedia.org/wiki/Magnetism?oldid=780435503> *Contributors:* CYD, Bryan Derksen, Zundark, Ed Poor, Stokerm, Peterlin-enwiki, Ktsquare, Waveguy, Heron, Isis-enwiki, Modemac, Stevertigo, Edward, Lir, Michael Hardy, Tim Starling, Llywrch, Menchi, Ixf64, Delirium, Egil, Ellywa, Ahoerstemeier, Mac, Theresa knott, Snoyes, Glenn, Mxn, Smack, Quickbeam, Charles Matthews, Reddi, Stone, 4lex, Pedant17, E23-enwiki, Ozuma-enwiki, Donarreiskoffer, Robbot, Fredrik, Jmabel, Texture, Caknuck, Sunray, Fuelbottle, Dina, Tea2min, Giftlite, Wolfkeeper, Bensaccount, Jfdwolff, Duncharris, Guanaco, Blizzarex, Brockert, DÅugosz, Gzuckier, Antandrus, Beland, Ctachme, Piotrus, Karol Langner, Icaims, Karl-Henner, Gscshoyru, DanMatan, Shotwell, D6, Discospinster, ElTyran, Rich Farmbrough, Pak21, Vsmith, Bender235, ESKog, Nabla, Lankiveil, Joanjoc-enwiki, Edward Z. Yang, Sietse Snel, Femto, CDN99, Bobo192, Meggar, Viriditas, Elipongo, 9SGjOSfyHJAQVsEmy9NS, Boredzo, MPerel, Haham hanuka, Nsaa, Alansohn, Redfarmer, Spangineer, Hu, Snowolf, Wtmitchell, TheMolecularMan, DV8 2XL, Gene Nygaard, Feline1, Vadim Makarov, Kazvorpai, Schultz.Ryan, Davidkazuhio, Benbest, Drostie, Duncan.france, Kmg90, M412k, Dysepsion, Slgrandson, JEB90, Magister Mathematicae, Edison, Koavf, Zbxgscqf, Strait, MZMcBride, EquinoX, Yamamoto Ichiro, Drnrgvry, FlaBot, RobertG, Mathbot, Nihiltres, RexNL, Gurch, SteveBaker, M7bot, Physchim62, King of Hearts, Chobot, Karch, The Rambling Man, Satanael, YurikBot, Oliviosu-enwiki, Hairly Dude, Jeffhoy, Petiatil, Mark Ironie, JabberWok, Chaser, Hellbus, Stephenb, Gaius Cornelius, NawlinWiki, Edinborgarstefan, SEWilcoBot, Wiki alf, Cryptoid, Dlugosz, Hv, Syrthiss, Jeremy Visser, Mistercow, Dan Austin, JustAddPeter, Sinewalker, Sandstein, Light current, Enormousdude, 2over0, Techguru, Closedmouth, Fang Aili, GraemeL, Roberto DR, HereToHelp, Chaiken, Junglectat, RG2, JDSpeeder1, GrinBot-enwiki, Zvika, Sbyrnes321, Inthepink, That Guy, From That Show!, SmackBot, KyleCardoza, Dubbin, InverseHypercube, Hydrogen Iodide, Melchoir, David.Mestel, Mjspe1, Unyoyega, Pkg, Proficient, ParkerHiggins, Masonprof, KocjoBot-enwiki, Jagged 85, Renesis, Ozone77, Yamaguchi 先生, Aksi great, Gilliam, Hmains, Skizzik, Kmarinas86, Bluebot, Ferix, Keegan, Jprg1966, MalafayaBot, Metacomet, J. Spencer, Octahedron80, Colonies Chris, Hongooi, Royboyocrashfan, Can't sleep, clown will eat me, Scott3, KaiserBot, Snowmanradio, Rrburke, Addshore, Celarnor, Wen D House, Fuhghettaboutit, Rolinator, Rajrajmarley, Akriasas, Knutsi, Danikayser84, DMacks, Where, Daniel.Cardenas, Sadi Carnot, Pilotguy, Yevgeny Kats, Charivari, Wikier.ko, GoldenTorc, DJIndica, Mnmogueira, The undertow, SashatoBot, MusicMaker5376, Petr Kopač, Dr. Sunglasses, Dtbtf, Akendall, UberCryxik, Scientizzle, This user has left wikipedia, JorisvS, Jim.belk, IronGargoyle, Postscript07, 16@r, Grapetonix, Special-T, Mr Stephen, Dicklyon, Geologyguy, Mdanziger, Iridescent, Rpb01r, Casull, Filelakeshoe, Chetvorno, Lahiru k, Harold f, CalebNoble, JForget, Thermochap, Ale jrb, Jaeger5432, Woudloper, El aprendelenguas, Whereizben, Nauticashades, Slazenger, Rossf18, Rifleman 82, Gogo Dodo, Xxanthippe, Pinestone, Chrislk02, Ssilvers, Omicronpersei8, A Mom, PoolDoc, Thijs!bot, Epbr123, ProDigit, Nonagonal Spider, Headbomb, Davidhorman, Dfrg.msc, Nick Number, Mr. Trustegious, Natalie Erin, Mentifisto, Hmrox, AntiVandalBot, Gioto, Widefox, Opelio, Quintote, Gangasudhan, Tim Shuba, Spencer, Sluzzelin, JAnDbot, MER-C, The Transhumanist, Andonic, Mkch, RebelRobot, Kerotan, Little-OldMe, Magioladitis, Bongwarrior, VoABot II, Doodoobutter, C d h, Anthonyramos1, Soulbot, Skew-t, Froid, SwiftBot, Catgut, Allstarecho, LorenzoB, Vssun, Crware, TehBrandon, DerHexer, MartinBot, Halpaugh, Uvainio, Keith D, Kostisl, CommonsDelinker, Science5, Shellwood, J.delanoy, Pharaoh of the Wizards, JA.Davidson, Lone Skeptic, LordAnubisBOT, Ipigott, GhostPirate, Warut, Jcwf, NewEnglandYankee, Mp50967, Vanilluv30, Mufka, FJPB, Cmichael, Usp, JulianB12, Jamesontai, Vanished user 39948282, Rising*From*Ashes, Mike by, Stuart07, Xenonice, Nmgrad, Deor, Thisisborin9, AlnoktaBOT, ALlocke, Station1, WOSlinker, Philip Trueman, Raminmahpour, TXiKiBoT, Oshwah, Paddy-B-Jr, Antoni Barau, Hqb, Z.E.R.O., Anonymous Dissident, Someguy1221, Jackfork, Amog, Tyler Matthews, Pjbcool103, Eubulides, Wenli, Andy Dingley, Spinningspark, Bcfootball, PwncakesN bacon, Ryne1, Insanity Incarnate, Brianga, Fischer.sebastian, TheBendster, ClarkLewis, IndulgentReader, FlyingLeopard2014, EmxBot, Aqwfyy, Biscuitin, Roberdor, SieBot, Tiddly Tom, Caltas, Yintan, Zoragotcha, Keilana, Happysailor, Flyer22 Reborn, Radon210, Sammyk214, Paolo.dL, Rafonescia, Smilesfozwood, Lightmouse, Techman224, Hobartimus, BenoniBot-enwiki, Werldwayd, Mygerardromance, JCPH, Denisarona, Electrodynamicist, ElectronicsEnthusiast, Martarius, De728631, ClueBot, Trojancowboy, Yoduh2007, The Thing That Should Not Be, Fluidchameleon, IceUnshattered, JanInad, Drmies, Mild Bill Hiccup, Blanchardb, Otolemur crassicaudatus, Puchiko, Masonm95, Pointillist, Russell4, Mspraveen, Samsee, Excirial, Jusdafax, Ninjackster, Monobi, Eekster, Lartoven, Brews ohare, Noor Qasmieh, Davdclehn, Erniesaurus, Ottawa4ever, Thingg, AL2TB, Jocelyne Heys-Gerard, Yuwangswissch, Versus22, Ryalisaivamsi, SoxBot III, Egmontaz, Flutterman,

Party, Editorofthewiki, Spitfire, Gnowor, Sakura Carletelet, ChucksGay123456789, Mitch Ames, WikHead, SilvonenBot, Khyranleander, HexaChord, Addbot, Xp54321, Proofreader77, American Eagle, S ortiz, Willking1979, Some jerk on the Internet, DOI bot, Bob sagget jr., Ron B. Thomson, Mr. Wheely Guy, LaaknorBot, Caturdayz, CarsracBot, Bassbonerocks, Chzz, TStein, 5 albert square, Numbo3-bot, VASANTH S.N., Tide rolls, William S. Saturn, Lightbot, Gail, Zorrobot, David0811, Legobot, Luckas-bot, Yobot, II MusLiM HyBrID II, MarcoAurelio, THEN WHO WAS PHONE?, Qui-Gon Jinn, Technobop, IW.HG, Ykral, Tempodivalse, Synchronism, AnomieBOT, Piano non troppo, Kingpin13, Ulric1313, Flewis, TheFronze05, Materialscientist, Karcih, Granito diaz, The High Fin Sperm Whale, E2eamon, Leif27, Clark89, MauritsBot, Xqbot, Sionus, St.nerol, Capricorn42, Jmundo, Saideepak.budaraju, Abce2, Frosted14, Kyng, Doulos Christos, Shadowjams, Kierkkadon, 老陳, IMNOTARETARDATALL, St. Hubert, Lordyou, GliderMaven, George2001hi, FrescoBot, Paine Ellsworth, Bobby72, S colligan, Nicktfx, HJ Mitchell, Silent78, Yoyo2222, Craig Pemberton, Jakhai1000, Citation bot 1, Pinethicket, I dream of horses, Edderso, PrincessofLlyr, 10metreh, Firozmusthafa, Pudgy78685, A8UDI, Flubber88, Jschnur, Serols, Robo Cop, Reconsider the static, Jauhienij, FoxBot, Tgv8925, TobeBot, Aliwikii, Dinamik-bot, Vrenator, TBloemink, Dan kelley90, Jeffrd10, Diannaa, Pmbeck, Weedwhacker128, Suffusion of Yellow, Splartmaggot, Jesse V., Mean as custard, Slon02, MELISASIMPSONS, EmausBot, Orphan Wiki, WikitanvirBot, Immunize, Octaazacubane, Karteek987, Racerx11, RenamedUser01302013, Dalgudmunsen, Solarra, Tommy2010, Dcirovic, K6ka, Lucas Thoms, Cabybara123, Hhhippo, JSquish, John Cline, Fæ, Josve05a, Shuipz3, Quondum, Crawlbeforeiwalk, EWikist, Wayne Slam, Ownedestroy, Maxrokatanski, Brandmeister, Apocalypse2009, Rigley, John Applesed, ChuispastonBot, RockMagnetist, Teapeat, 28bot, Sonicyouth86, Petrb, ClueBot NG, Adawg117, Bchaplucian, Alex-engraver, Cntras, The Troll lololololololol, Helpful Pixie Bot, Stanlste, Strike Eagle, Bibcode Bot, Cmandouble3, Rijnatwiki, MusikAnimal, Changer-guy, JacobTrue, RaulRavndra, Maxellus, Thekillerpenguin, EntangledSpins, Srikar33, Soerfm, CitationCleanerBot, MrBill3, Zedshort, Glacialfox, Millennium bug, ChrisGualtieri, Embritchan, Yammer68, Fizped-enwiki, MadGuy7023, Bluedot951, SoledadK-abocha, Denis Fadeev, TwoTwoHello, Numbermaniac, NinjaNightMare12, Reatlas, Harish.awasthi, Trollarc26, DavidLeighEllis, To-bythedog1, Coz12345, Innovativ, Manul, SpecialPiggy, JaconaFrere, Skr15081997, SufferinSuckatach, Monkbob, Niuthon, Opencoop, Justin15w, Mrmister6123, MacWarcraft, Scarlettail, Trackteur, Shantygoreman, Suraj 967, Martinpalla123, MRD2014, The Last Arietta, KH-1, Elite Whitesands Force, Tymon.r, RippleStrike, Ak0hlm, KasparBot, Miskiiy, Mf siddiqi, Creadilo, TheDadeOne, Entranced98, Xdxdx123456789123456789, Rasimmons, ThePlatypusofDoom, Yasmine4correa123, Gulumeemee, Liamclarky1, Bender the Bot, 22KAMOLIDDINAKBAROV, Gambler1478 and Anonymous: 985

- Mahabharata** Source: <https://en.wikipedia.org/wiki/Mahabharata?oldid=783092756> Contributors: Mav, Bryan Derksen, Berek, WillWare, Arvindn, Hari, KF, Ubiquity, Paul Barlow, Gabbe, Gaurav, Yann, Alfio, Looxix-enwiki, Mkweise, Ahoerstemeier, Kricxjo, Mioc, Gyan, Den fjättrade ankan-enwiki, Alex756, Kaysov, Vivin, Pizza Puzzle, Seth ze, Hashar, WolfgangRieger, Charles Matthews, Gokul madhavan, Jay, Tschild, Imc, Jose Ramos, Anupamsr, Bloodshedder, AnonMoos, Carlosuarez46, Robbot, 1984, Xiaopo, Goethean, Chancemill, Hemanshu, Meelar, Bkell, Hadal, Mandel, BovineBeast, Adam78, Xyzyzya, Jpo, JamesMLane, Akella, Aphaia, Orpheus, Risk one, Tom Radulovich, Michael Devore, Niteowlneils, Catchanil, PRB, Per Honor et Gloria, Isidore, Utcursch, LordSimonofShropshire, Pgan002, Ran, Antandrus, Eroica, Lesgles, Nograper, Mukerjee, Sam Hocesvar, Robin klein, Didactohedron, Svarma, M1ss1ontomars2k4, Fanghong-enwiki, Accenray, Gajamukhu, Rfl, CALR, Chaipau, Discospinster, Rich Farmbrough, Ram einstein, Localizer, Wclark, Factitious, Rblumberg, Spundun, Ahkond, Dbachmann, Mani1, Bender235, Alren, Kwamikagami, Mwanner, Bendono, Wareh, Bill Thayer, NetBot, Alcidebava, HPN, Duk, Kbir1, Ogress, Papertree, Raj2004, Alansohn, Kanie, CyberSkull, Wiki-uk, Ricky81682, Panacea 11, LRBurdak, Psychofox, Eukesh, Mad Hatter, Harej, Fantumphool, Sfacs, Kazvorpall, Agingjb, Stemonitis, Engineerstthumb, Velho, Woohookitty, RHaworth, Brhaspati, Shreevatsa, Robert K S, Valasai, AshishG, Dangerous-Boy, SDC, DanCBJMS, Cbyneorne, Skrpriv, Raguks, Graham87, BD2412, Kbdank71, Nlsanand, Rjwilmsi, Koavf, Barklund, Quiddity, Avianwing, Wikirao, TheRingess, Frenchman113, Sango123, Fayssalf, FlaBot, Osprey39, Sunayana, RexNL, TheDJ, Saketh, TeaDrinker, Grasadh, Alphachimp, Andriesb, Gurubrahma, Mallocks, Chobot, DaGizza, K2wiki, Attraxion, Uriah923, Satanael, YurikBot, Wavelength, RobotE, Mikalra, JarrahTree, Musicpvm, Mark Ironie, Shell Kinney, Gaius Cornelius, Rsrikanth05, TheMandarin, Devb, Srini81, Msikma, Bloodofox, Nishith Prabhakar, Journalist, Dppowell, Pravinjha, Yaja 1991, Rmky87, Vastu, Bucketsofg, DGJM, Kyle Barbour, Priyanath, GeoffCapp, Deepak-enwiki, Sowmyagopal, J S Ayer, Nightpotato, Rudrasharman, Chopper Dave, Mastabahabibel, TBadger, Shyam, Tyronen, Willtron, Pratheeps, WIN, Riyazusman, Varatec, Mercer66, FieryPhoenix, SmackBot, Imz, Reedy, Bomac, Jagged 85, Thunderboltz, Miljoshi, David G Brault, BiT, Pretzellogic, Skris, Gilliam, Ohnoitsjamie, Hmains, Varmaa, Schmittey, Anachronist, TimBentley, Shaggorama, Jai Maharaj, Jeysaba, MalafayaBot, Vsrawat, Bob the ducq, TheFeds, Cparmar, Iskcon, SWDesai21, DHN-bot-enwiki, Indra the aryan, N00854180t, Amarrg, Lilamrta, VirtualSteve, NYKevin, Can't sleep, clown will eat me, Crowbaaa, Tamfang, OrphanBot, Alaiche-enwiki, Grover cleveland, Stevenmitchell, Huon, Jwy, Bigturtle, Ikavaku, Wikifan1248, GourangaUK, Neoviky, Nmpenguin, Liguembot, Mlpkr, Rissa, Qmwne235, Ananthp, Andrew Dalby, Paul 012, SashatoBot, MantraTantra, Nishkid64, Soap, Ziga, Juekitlor, Anooahapour, NongBot-enwiki, Ickydogg, CPAScott, RandomCritic, A. Parrot, Remigiu, Makyen, Beetstra, Ambuj.Saxena, Qualihost, MaulikK, MTSbot-enwiki, Raviekant, SFS, Jijithnr, Iridescent, Rayfield, Shoofofdeath, Az1568, Bertport, Virad, Noble eagle, Grammatical error, JForget, KNM, Garwig, Mattbr, Shiva's Trident, Giko, WeggeBot, Godardesque, Equendil, Cydebot, NandaSahadeo, Aristophanes68, Hebrides, Pgg7, Blaisorblade, Ashycool, Adityarn, Doug Weller, Arvind Iyengar, DumbBOT, DBaba, Ghostexorcist, Sharonlees, Kozuch, Lo2u, S raghu20, Mattisse, Thijs!bot, Peter.M.D., Wakantanka, Csb csb, Missvain, Amachu-enwiki, Astynas, Gup-tasuneet, Davidhormon, Rex14, Nick Number, Anirudh777, Escarbot, WinBot, Pupunwiki, Luna Santin, Shirt58, DarkAudit, IndianGeneralist, Naveen Sankar, Indian Chronicles, Wahabijaz, JAnDbot, Ekabhishek, Kaobear, Bakasuprman, Chanakyathegreat, KuwarOnline, Ibis3, Alastair Haines, anacondabot, AshwiniKalantri, Magioladitis, SYLFan74, Kajasudhakarakababu, Sindhutvavadin, Michaelwoo2k, Hekerui, Abh1984, Tuncrypt, Iitkgp.prashant, Sarath.menon, David Eppstein, Aziz1005, Vssun, Dharmadhyaksha, Hoverfish, JaGa, Xtifr, FisherQueen, Skumarla, MartinBot, Notmyhandle, Rettetast, Bissinger, Jbarot, CommonsDelinker, Gunkarta, Freebosen, Gnanapiti, Abecedare, Skumarlabot, Wikramadithya, Murlivala, Bot-Schafter, DarkFalls, Naniwako, Gurchzilla, Somdebg, Zerokitsune, DadaNeem, SJP, Nareshgupta, Sarayuparin, Arasan.rl, Robertgreer, CanadaAotS, Kanakaraju, Treisijs, Raakeshp, Jbhatt, Useight, Dolugen, Snehagargeya, The Behnam, Idioma-bot, Sbharti, Redtigerxyz, Sam8477, Moksha88, Deevilsair, ChaosNil, Debnathsandeep, Sunil-srivastava, Deepak kcextc, Swamy g, TXiKiBoT, Vaishu2, NachiketDe, Sithemadmonkey, Arunadasi, Fertejol-enwiki, Anna Lincoln, Steven J. Anderson, Mymilkshake23, HICAT, Sniperrz11, Buddhipriya, Vishwesh.jha, Marq au, Sloth039, Wiae, Cantiorix, Synthebot, Tntsda, Alaniaris, AlleborgoBot, ChristopherDGibbons, Roland zh, Saintmental, Cvenky, Humboldt, SieBot, Sunukdr16, Nihil novi, Hertz1888, Callipides-enwiki, Bmader, Baileyhowell, Parth me, Tarun kt, Knowledge-one, Mankar Camoran, HamadaFanFFSM, Ramkumaran7, Taggard, Getallica, OKBot, Jahilia, Hamiltondaniel, Varanwal, Sitush, Artistpro, Theo777, Randy Kryn, Patalbhuvaneshwar, Martarius, ClueBot, Shruti14, Aditya0908, By2coffee, Joao Xavier, RainDew, DragonBot, Jusdafax, Kroyraj, PixelBot, Coinmanj, Rao Ravindra, Nownownow, Lusosromulus, Stefano510, Ngebendi, Antiquary, SchreiberBike, Simonbrodbeck, Friedlibend und tapfer, Apaudel, Gujaratiauthor, SoxBot III, Wikidas, Parvativaish, DumZiBoT, Boleyn, XLinkBot, Kalavati, Fastily, Mronmark, Kannan91, Mitsube, Cminard, Ism schism, SilvonenBot, Nramanathan1983, Noctibus, Foreverknowledge, Subhasshetty, Toopridub, Ad-dbot, Guyfromboracay, Narayansg, Dixitsandeep, Yobmod, Metsavend, Lane123456, Ashton1983, Download, Ketan.saini, NittyG, AnnaFrance, Anam Gumnam, Zacmoody, Nizil Shah, Bijou17, Numbo3-bot, Arindam Bandyopadhyay, Rajkumar234, Nersy, Zorrobot,

Triphala, Xenobot, Mark lecras lover, Ben Ben, Legobot, Luckas-bot, Perfumaniac528, Yobot, Abhijitmaeth, Holllomanme, Amirobot, THEN WHO WAS PHONE?, Seema429, AnakngAraw, Browndog72, Bility, AnomieBOT, Arjun G. Menon, Abstruce, AdjustShift, Adellefrank, Hemantajay, MaterialsScientist, Citation bot, Srinivas, ArthurBot, Star reborn, LilHelpa, RajeshUnuppally, Xqbot, Mathupa01, TinucherianBot II, Engineering Guy, Divyavidya, Beprop, Dharmil007, Apoorv020, Srich32977, GrouchoBot, Renjithkumar c, Mythlace, Diogenesclincico42, Omnipaedista, RibotBOT, Shillika, Gangetic-aryan, BGhimire, Baudha, FrescoBot, Kanchanraste, Aerospice, Fgpilot, Mukerjibapi, Willard84, Akash.kad, Lordharrypotter, Civilizededucation, Citation bot 1, Hegades, Hometech, Moon-Line, Rohitbhajain, SpacemanSpiff, I dream of horses, Zippymarmalade, The Arbiter, Webian.subarna, SergeWoodzing, Sukush786, Xdivider, FoxBot, Trappist the monk, Lotje, Therash09, Abczak, Alokprasad, Bigsuperindia, Executore, Ripchip Bot, VOYAGER 1, Rayman60, Vyas.siddharth, EmausBot, Cinosaur, WikitanvirBot, J ramans, Dewritech, Mkbdcce, SteveM123, Mkbdtu, Merushikhar, Lostinindia, Mayurasia, Harryparkar, Abecedere, Vikramaditya, The Blade of the Northern Lights, Fungsukwangdu, Kkm010, Richard asr, ZéroBot, Charbak Dipta, Myth&Truth, NothingImpossible, Duryodhn, Bhagdatt, LordSuryaofShropshire, Screensavant, Koresdcine, Erianna, Coycan, Vanished user qwqwj9r8hwrkjdnvkanf0h4, 11 Arlington, JahaalChakravarti, ChuispastonBot, Hisagar123, Earthwit, Spicemix, Rajaram Sarangapani, Ronakshah1990, Hamlet 2010a, Hawa-Ave, Uwo222, Hind meri jaan, Naraharisumadhwa, Harsimaja, Helpful Pixie Bot, Thisthat2011, Titodutta, BG19bot, MKar, Lo Ximiendo, PhnomPencil, Marcocapelle, Demetriusss, Joshua Jonathan, Risingstar12, Polmandc, Parik92, MohaiminPatwary, Nemo Kartikeyan, Shrawanroy, Khazar2, Kamleshp798, Cpt.a.haddock, Hridith Sudev Nambiar, Prof.Dr.A.Yeshuratnam, BrightStarSky, Dexbot, Mogism, Prohairesius, Rahul Ramamoorthy, Napoleon 100, Kingcircle, Graphium, Poipoise, SY23454, Prabhu Prasad Tripathy, Piggy58, Writeecrit, Iztwoz, CensoredScribe, Mas Rodin, Swamiblue, The Herald, JimRenge, FireflySixtySeven, Uj1202, Babagi anadi, Bladesmulti, Srisanjana venkatesan, Ms Sarah Welch, Srikanth Aviator, Paraboloidal, Abhi.Wiki.Account, Droigheann, VictoriaGrayson, India142, Filedelinkerbot, Prymshbmg, Sai santhosh00, Tigercompanion25, Summichum, SkrapMason, Contentlagh, Human10.0, Narky Blert, Avlokeskumar1203, Vreswiki, Julietdeltalima, Tamil 120, Bongan, GoldCoastPrior, RightBKC, Conradjagan, User000name, KasparBot, TheMagikBOT, Capankajsmilyo, Koodfaand, Anjali das gupta, Gotitbro, Rajkumar 1 02, InternetArchiveBot, Orisingsun, Bender the Bot, Here2help and Anonymous: 630

- Malthusian catastrophe** *Source:* https://en.wikipedia.org/wiki/Malthusian_catastrophe?oldid=778415954 *Contributors:* Derek Ross, CYD, Wesley, Bryan Derksen, The Anome, Pgdudda, Roadrunner, SimonP, AdamRetchless, R Lowry, Hephaestos, Michael Hardy, Kku, Dcljr, Ellywa, Ahoerstemeier, Ryan Cable, Snoyes, BuzzB, H7asan, BAXelrod, Robertkeller, Smack, Grendelkhan, Greglocock, Itai, VeryVerily, Populus, Omegatron, Kizor, Peak, Securiger, LGagnon, Aetheling, Vishruth, Cutler, Alan Liefing, Grant65, Bobblewik, Quadell, Beland, Rdsmith4, One Salient Oversight, Atlatawake, PhotoBox, Mike Rosoft, Rich Farmbrough, Dave souza, Pavel Vozenilek, Stbalbach, Jnestorius, CanisRufus, Imoen, SS451, Dalf, Bobo192, Gary, John Quiggin, Mac Davis, Titanium Dragon, BRW, Kaibabsquirrel, Ghirlandajo, Lebob (renamed), Ultramarine, Phillipsacp, Scjessey, Bkwillwm, GregorB, Palica, Marudubshinki, SMC, DonSiano, Ohanian, Itinerant1, Piniricc65, No Swan So Fine, Hatch68, Volunteer Marek, Shardsofmetal, Wavelength, Gatsby-enwiki, Gaius Cornelius, David R. Ingham, Muntuwandi, Rick Norwood, Kvn8907, Kyle Barbour, Zer0render, AlexD, 314, Hide&Reason, Luk, SmackBot, RDBury, InverseHypercube, Hammerite, Gunnar.Kaestle, Yamaguchi 先生, Gilliam, Thumperward, Berland, Nixea-gle, Gurps npc, Risker, Lambiam, Anlace, AdVader-enwiki, Rkmlai, Publicus, Lenoxus, Vannmi, CRGreathouse, CmdrObot, Coolcamxl, Aaronak, Ibadibam, Cydebot, Trasel, Grahamec, Teratornis, Maziotis, ATD-enwiki, BCSWowbagger, PerfectStorm, Anupam, The Dark Side, Bobo159, Uruiamme, Haha169, SvenAERTS, Mack2, Phanerozoic, Athkalani-enwiki, WikipediaProlific, Nmcmurdo, 100110100, Vultur-enwiki, Magioladitis, VoABot II, Animum, Cgingold, R'n'B, Flo422, Rlsheehan, Cpiral, Mikael Häggström, SJP, Jarry1250, Simonross99, VolkovBot, Chemical-Bond, Badly Bradley, Everything counts, SpuGG, Synthebot, Phmoreno, Yop83, Alcmæonid, Chenzw, Thunderbird2, Vvevo, Skipsievert, Lightmouse, Svick, Anchor Link Bot, Abmcdonald, Tradereddy, SallyForth123, ClueBot, Lysine23, Vivio Testarossa, Adriansrfr, NJGW, Vigilius, Crownsnest, Rickremember, Jondk, Mitch Ames, Vianello, JCDenton2052, Fieldday-sunday, Tassedethe, Smeagol 17, Legobot, Tediato, Luckas-bot, Yobot, AnomieBOT, Xqbot, Gigemag76, Celuici, Citation bot 1, Killian441, HRoestBot, Yunshui, GregKaye, RjwilmsiBot, Phlegat, Jdkag, Westley Turner, Jay-Sebastos, Ain92, Rigley, Tricee, ClueBot NG, Joefromrandb, Thebomb556, Helpful Pixie Bot, Athkalany, Marcocapelle, 123957a, Kjsnowday, Wer900, Telfordbuck, GeneralConstruction, Madreterra, BrianXVX, Cosmia Nebula, ApcehCraft, EJS2014, Mitzi.humphrey, BlazookaJoe, Jvmandela, God's Godzilla, Azrafanuwar and Anonymous: 174
- Man bites dog (journalism)** *Source:* [https://en.wikipedia.org/wiki/Man_bites_dog_\(journalism\)?oldid=780780023](https://en.wikipedia.org/wiki/Man_bites_dog_(journalism)?oldid=780780023) *Contributors:* Delirium, Rbraunwa, Bearcat, Wereon, PBP, Pascal666, Edcolins, SYSS Mouse, Eyrian, Bender235, Richard Taylor, Aquillion, Grovel, VoluntarySlave, Blaxthos, Brhaspati, Commander Keane, ShadowyCaballero, DustWolf, VolatileChemical, Bjanay, Epolk, Korny O'Neal, Zargulon, Danielx, Bdve, Fernandobouregard, SmackBot, Nbarth, Ted87, Tamfang, Cybercobra, Jesuschex, J 1982, Quantum Burrito, Exomni-enwiki, Avyfaian, Cydebot, JamesLucas, Thijs!bot, EnthusiastFR, Hemidemisemiquaver, Kane2742, Aleksandr Grigoryev, 97198, NewEnglandYankee, Railwayfan2005, TreasuryTag, Mudwater, Antoncampos, Doctorfree, Stratman07, Henrytow, SummerWithMorons, Onemanutopia, EEng, Yobot, RjwilmsiBot, Mattimck, John of Reading, Slightsmile, Solomonfromfinland, A930913, Theopolisme, Badon, Esuthest, Jodosma, Fixture, Demoncathandler, Imaginedd, Covculture, GeneralizationsAreBad, Vanessa YJ and Anonymous: 52
- Mandelbrot set** *Source:* https://en.wikipedia.org/wiki/Mandelbrot_set?oldid=783197646 *Contributors:* AxelBoldt, Brion VIBBER, Mav, Zundark, Timo Honkasalo, Dave McKee, Youssefsan, XJaM, Ghakko, B4hand, KamikazeArchon, Michael Hardy, Oliver Pereira, Kidburla, Dominus, Kku, Tango, Dcljr, Cyp, ZoeB, JWSchmidt, Setu, Lupinoid, AugPi, Jeandré du Toit, Evercat, Charles Matthews, Timwi, Nohat, Random832, JoshuaBowman, Dysprosia, Hyacinth, Saltine, Fibonacci, JonathanDP81, Pakaran, Garo, Denelson83, Phil Boswell, Hankwang, Fredrik, Jredmond, Gandalf61, Chopchopwhitey, P0lyglut, Cholling, 75th Trombone, Leedar, Cyrius, Connelly, Giftlite, Dbenbenn, Raymond Meredith, Gene Ward Smith, Wolfgangbeyer, Vfp15, Fropuff, Everyking, Frencheigh, Sundar, Gracefool, Solipsist, Mackerm, Gzornenplatz, Peter Ellis, PhiloVivero, Geni, LucasVB, MarkSweep, IYY, MarkBurnett, Gauss, Sam Hovevar, Chadernook, Ultrasine, Edsanville, HenHei-enwiki, Sword-enwiki, Valmi, Gazpacho, Shiftchange, Mormegil, Rfl, Rich Farmbrough, ArnoldReinhold, Solkoll-enwiki, Mikkell, Paul August, Bender235, Mattingly23, Pt, El C, EmilJ, Touriste, Army1987, C S, .:Ajvol.:, Davidgothberg, Minghong, Dfeldmann, Crust, LutzL, Julesruis-enwiki, Anders Kaseorg, SurrealWarrior, Sligocki, Jackliffde, BernhardH, Malo, Dschwen, Vella, Isaac, AquaDoctorBob, Lerdsuwa, Bsadowski1, Mikenolte, John11235813, Kay Dekker, Spot, Oleg Alexandrov, Linas, Duncan.france, OdedSchramm, Tabletop, Kelisi, Wurzel-enwiki, CharlesC, Snapnz86, Marudubshinki, Technoshaman, Mandarax, BD2412, Chickenhead, Josh Parris, Rjwilmsi, Pdelong, Jivecat, Quiddity, TheRingess, Salix alba, R.e.b., Brighterorange, Rbeas, MikeJ9919, BobDole, Yamamoto Ichiro, Geraldkrug, John Baez, Nowhither, Mathbot, SiriusB, RexNL, Gurch, Czar, KFP, BabyNuke, Tedder, SteveBaker, Kri, Chobot, Dylan Thurston, Visor, YGingras, Nagytibi, Unc.hbar, Bgwhite, Adam J. Sporka, Algebraist, Banaticus, Wavelength, PiAndWhippedCream, Hairy Dude, The Great Zo, Conscious, Taejo, Pi Delport, Chaos, GeeJo, Anomalocaris, Austinmayor, David R. Ingham, NawlinWiki, ENeville, Wiki alf, Petter Strandmark, ErkDemon, Deskana, Welsh, Thiseye, Tim Goodwyn, Tony1, Seudoname, Crisco 1492, Open2universe, RDF, Thnidu, Knotnic, Nikkimaria, Rdnzl, Redgolpe, Banus, JD-speeder1, Nippoo, Finell, Cyclone231, NetRoller 3D, AndrewWTaylor, SmackBot, ZorkFox, Adam majewski, Jstumpel, Jonathan

Karlsson, J.Steinbock, Anachronist, Chris the speller, Gaiacarra, Igul222, Nbarth, Metalim, Zom-B, ToobMug, Modest Genius, Simpsons contributor, Max David, Michael.Pohoreski, Xiner, Georg-Johann, Andreoli.carlo-enwiki, Japeo, Vancera, UU, Matthew Chapman, Uncleosbert, Tenmiles, TMW, J.smith, Ck lostsword, Birdman1, Rory096, J. Finkelstein, Ourai, OliverWKim, Bethchen, Khim1, Mgi-ganteus1, Loadmaster, Fractalnichel, Rainwarrior, Stikonas, Dr.K., Inquisitus, Pejman47, Stephen B Streater, Tó campos-enwiki, Trialsanderrors, Lasserempe, Rowanseymour, Parajedi, CmdrObot, Memetics, David Traver, Williampfeifer, Myasuda, Kjknohw, Nauticas-hades, Sopoforic, Doctormatt, Ntsimp, Reywas92, Galinda-enwiki, MC10, Doomed Rasher, Fightinwords, Protious, UberScienceNerd, Curtigator, JAF1970, Mojo Hand, Headbomb, Oldneuro, John Comeau, Paxinum, Greg L, Escarbot, BigJohnHenry, Eleuther, Rps, Vigeesh, Clamster5, Tim Shuba, VictorAnyakin, Kaini, Steelpillow, Ericoides, Friv, MegX, Aacini, .anacondabot, Penubag, Magio-laditis, WolfmanSF, Jarekt, Vancouverbagel, Baccyak4H, Catgut, Digiho, David Eppstein, Drewmandan, GermanX, David Hawley, Mgg4, Gwern, MartinBot, Arjun01, R'n'B, CommonsDelinker, Lilac Soul, Prokofiev2, Abecedare, Melamed katz, Ciotog, Ianbogs, Martinhellman, Supuhstar, 83d40m, Potatoswatter, Mikemcdee, Joshua Issac, Firerocketm, Slowspace, Smallfixer, Signalhead, Deor, Wikkeddit, VolkovBot, Plaball9418, Enderminh, Danwills, LokiClock, Nousernameleft, TXiKiBoT, Myles325a, Sean D Martin, Liko81, Turm, Intchanter, Cuddlyable3, Wingedsubmariner, MartinPackerIBM, Lova Falk, Burntsauce, Homer29, Dbelange, Milan va, Cal-tas, Soler97, Droog Andrey, Amys eye, Schalik, Sjewells53, Android Mouse Bot 3, R0uge, Nskillen, Svick, Meesern, Mr. Stradivar-ius, Bashewo, WikipedianMarlith, Jacob.vankley, FlamingSilmaril, ClueBot, Salanax, Plastikspork, Rudolf Schürer, Fotoshop, Maniac18, Cp111, DragonBot, Jeanenawhitney, Tnxman307, 88lesix88, Dekisugi, Jerstlouis, BOTarate, Ycarcomed, EliteHEAD, PCHS-NJROTC, Onomou, Goodvac, Mjbshaw, FractiousJell, Darkicebot, XLinkBot, Synchman, SkyLined, Jabaste, Drolz09, Addbot, Cxz111, Blahblajando, Rami.morgan, DOI bot, Tencv, Download, LinkFA-Bot, Tassedethe, Lightbot, ScAvenger, Matěj Grabovský, Balabot, Starplasm, Legobot, Luckas-bot, Yobot, Morph78, Amirobot, Medical geneticist, THEN WHO WAS PHONE?, Phobomaniak, Doctor-JoeE, Salisbury-99, Sawyeriii, MapartUS, 9258fahsflkh917fas, Piano non troppo, Informationtheory, Citation bot, Georgepowell2008, Xqbot, Srich32977, HannesP, RibotBOT, Klaus Zipfel, Adlab, Shadowjams, SirSeal, GliderMaven, FrescoBot, Mnast-enwiki, Teine-savaii, OgreBot, Tkuvho, AstaBOTh15, Jordgette, Lotje, Vrenator, Henry hedden, Specs112, Cutelyaware, Metricist, Jowa fan, Ar-tuno, EmausBot, David R Byrne, TeleComNasSprVen, QuentinUK, Gertbuschmann, The Nut, Quondum, SporkBot, Wayne Slam, TyA, AlecTeal93, Maschen, Zueignung, Yclept:Berr, Nerdlord, Anita5192, Mikhail Ryazanov, ClueBot NG, Yourmomblah, Frietjes, Dreth, Einottaja, Helpful Pixie Bot, Wikiman211, BG19bot, Chompinator74, PhnomPencil, Reislust, Bubby33, Trevayne08, Bob o Shiska, Mjjean, Brad7777, Parissou, Garjira, Josep m battle, BattyBot, Tomrdelhi, Spoink H1N1, Konsoul, Craftmanic, Jimw338, Khazar2, PirulestheWorld, Fordcars123, Dexbot, Jamesx12345, Soda drinker, Mmitchell10, Dennisbreton, Josep m battle2, Karellen32, Escspeed, Geonat, Ntabakova, Mylittleanon, Rawrkal, Monkbob, That kiwi guy, Alex Tav, MRD2014, Psw7687, Helibene, TheMagikBot, D-4597-aR, MusikBot, Anonymous Recent Contributor, InternetArchiveBot, MYTHILI PRABAHARAN, FractalJaguar, DeveloperDan123, Fmadd, NoToleranceForIntolerance, JoMM, Dvd video, Grant 53, Nik2020, RinSer, Cozmie rayz and Anonymous: 485

- Marochinate** Source: <https://en.wikipedia.org/wiki/Marochinate?oldid=770698998> Contributors: Branddobbe, Varlaam, Pasquale, Flapdragon, Lou Crazy, Patsw, Ashley Pomeroy, Tabletop, GraemeLeggett, Rjwilmsi, Tim!, Carl Logan, Ghepeu, FayssalF, Ian Pitchford, Pevernagie, Bgwhite, EamonnPKeane, RussBot, Hawkeye7, Thiseye, Attilios, SmackBot, Jagged 85, Michael Dorosh, Timeshifter, Robbstrd, Roscelese, Elendil's Heir, Jmlk17, Zahid Abdassabur, General Ization, Kransky, AGK, Az1568, FairuseBot, Ludwig Boltzmann, Aherunar, Cydebot, After Midnight, Buistr, Wandallstouring, Ore Priest, Smith2006, Haber, Kaobear, Giovanni Giove, Kirrages, Shardan, VoABot II, Caranorn, SandyDancer, Kojozone, DH85868993, Gwen Gale, Philip Trueman, Nedrutland, Brianga, Newzild, Kiras72, Excirial, Alexbot, Ngebendi, Carriearchdale, BOTarate, Arturolorioli, XLinkBot, Rror, Integrita, Addbot, Download, Lightbot, Yobot, Pbtogourou, AnomieBOT, Tryptofish, Madridreal, Jcrt, Lihelpa, Xqbot, FrescoBot, RjwilmsiBot, EmausBot, John of Reading, Filmfluff, Dk1919 Franking, Linnigol, Helpful Pixie Bot, BG19bot, The Almighty Drill, BattyBot, Prof. Squirrel, Cyberbot II, Bloody hello, Monkbob, Generale Lee, L1T5YAZXBF OP4D1ULI7L NB4DJ265Z5 MQ9Y110E0V 9VSKAIZQT2, Targje, InternetArchiveBot, GreenC bot and Anonymous: 49
- Mayflower** Source: <https://en.wikipedia.org/wiki/Mayflower?oldid=778509962> Contributors: WojPob, Mav, Sjc, Rmhermen, SimonP, Isis-enwiki, Zippy, Hephaestos, Someone else, Infrogmation, Jrcrin001, Ixf64, Alfio, Ahoerstemeier, Stan Shebs, CatherineMunro, Julesd, LouI, Rossami, Csernica, Markb, Timwi, IceKarma, Paul-L-enwiki, Bearcat, Henrygb, Rursus, Ojigiri-enwiki, Hadal, Wereon, Jone-enwiki, Seanol, Walloon, Dmn, Decumanus, DocWatson42, Pmaguire, Admiral-enwiki, JilandJack, Fys, Nova77, SarekOfVulcan, Gzuckier, Antandrus, Beland, OverlordQ, Ejgm, Cape cod naturalist, Erik Garrison, TiMike, Neutrality, Joyous!, TJSwoboda, Uk-expat, Discospinster, Guanabot, Pmsyyz, Stbalbach, Bender235, ESKog, Nysalor, RoyBoy, Sole Soul, Bobo192, Smalljim, Func, Nivagh, Smarmon, Jolomo, Cunningham, BillyTFried, MPerel, Ral315, Pearle, Jumbuck, Alansohn, Couperman, StanZegel, Jaw959, Hattrem, IMeowbot, Stemonitis, Boobayner, Beej71, Richard Arthur Norton (1958-), Billhpik, Bkwillwm, Bluemoose, Isnow, Talskiddy, Wayward, GraemeLeggett, Dysepsion, Mandarax, Graham87, Magister Mathematicae, Coemgenus, Nightcream, Cxbrx, Boatman, Ttwaring, MWAK, Emmanuel83, Jcmurphy, Nihiltres, NekoDaemon, RexNL, Nine999999999s, Gurch, BjKa, Alexjohn3, Preslethe, Silivre-nion, Shauni, Saint-djc, Daveblack, Roboto de Ajvol, Ravenswing, YurikBot, Wavelength, AlanFord, Adam1213, Mark Ironie, Gaius Cornelius, Pseudomonas, Wimt, NawlinWiki, Astral, Rjensen, Haranoh, SirWoland, Brandon, Brian Crawford, Moe Epsilon, CorbieVreccan, Wknight94, FF2010, Livitup, Wechselstrom, Guillom, Shropshire Lad, Johnpseudo, Stuhacking, Jonathan.s.kt, Jedward-cooper, Vanka5, SmackBot, Mdd4696, Gif32, Carbonix, Alessandro, Siradia, PeterSymonds, Gilliam, Hmains, Fogster, Durova, Chris the speller, Philosopher, JonRidinger, Dr bab, Jprg1966, SchiftyThree, Afasmit, Scwlong, Robogun, Skidude9950, Rrburke, Edivorcer, Midnightcomm, Sholom, Sapwood2, TedE, Zen611, Lcarscad, The PIPE, Salamurai, Where, DDima, Kukini, Nbierma, Esrever, ArglebargleIV, Ser Amantio di Nicolao, Rklawton, Kuru, Guroadrunner, J 1982, Ratchet19, Heimstern, SilkTork, Nathanww, Regan123, Gary13579, Waggors, PSUMark2006, Joseph Solis in Australia, Theone00, J Di, Haus, Civil Engineer III, Courcelles, Anger22, Tawker-bot2, Asteuartw, Dan1679, JForget, Betaeleven, Jesse Viviano, Jimknut, Ballista, Timtrent, Ken Gallager, Nilfanion, Knute-enwiki, Cydebot, Andreasegde, Rsarlls, Gogo Dodo, Flowerpotman, Palmiped, Odie5533, DumbBOT, Chrisk02, Gaydenw, Rfin39, Thijs!bot, Epr123, Wikid77, LeeG, Olahus, Marek69, Vertium, NorwegianBlue, James086, Nezzadar, JustAGal, Abdelkewi, Mark Geesey, Dawnseeker2000, Escarbot, LachlanA, Mentifisto, AntiVandalBot, Kieran608, Antique Rose, Paste, Rabbi-m, Lordmetroid, Deserts-ky85450, Salgueiro-enwiki, Qwerty Binary, Jan Friberg, Barek, John a s, Bodragon, Bearpatch, Roleplayer, Acroterion, Mcr hxc, Bong-warrior, VoABot II, Scribble Monkey, Websterwebfoot, JNW, Farquaadhnhmnm, Tedickey, Marcica, KConWiki, Catgut, Mtd2006, Der-Hexer, Philg88, Edward321, Markrr, Lewismatson, Orosio, Gjd001, MartinBot, Fool4jesus, Morgan Wright, Sm8900, Exostor, Jimwb, RockMFR, J.delanoy, Trusilver, SimpsonDG, Kjlfletcher, Austin Meredith, YankeeTexan, Indeed123, Sallen2006, Rocket71048576, Chiefsub68, Mufka, Pundit, Fjbfour, Gwen Gale, Kitkatcrazy, Wikimandia, Ja 62, TheNewPhobia, Halmstad, Funandtrvl, Xnuala, Raime, Jacobtowne, VolkovBot, CWii, Calixte, Jeff G., Trcrev, Sjones23, Al.locke, Philip Trueman, Nhayes2004, Alacarte, A4bot, AgamemnonZ, Ann Stouter, Anonymous Dissident, Someguy1221, Calbookaddict, Melsaran, Thirly3600, Broadbot, Ripepette, ^demonBot2, Raymondwin, Cremepuff222, Waycool27, Enviroboy, Judgeking, Doeric96, Stavor, FlyingLeopard2014, Romuald Wróblewski, SieBot, Robert Loring, Tresiden, Sumscaler, Hertz1888, Legion fi, Matthew Yeager, Yintan, Typric, GlassCobra, Happsailor, Quilker, Rhanyeia, Goustien, Yone Fernandes, Iain99, Techman224, Bmhtayl, JohnnyMrNinja, Maralia, Calebchiam, Escape Orbit, Randy Kryn, Gren-

ney, Carole.appel, Jens58, Keinstein, Arun 01, ClueBot, Avenged Eightfold, The Thing That Should Not Be, All Hallow's Wraith, Traroxursox, Sparkyboy1992, Jmn100, Niceguyedc, Estevoaei, Blanchardb, Dylan620, TypoBoy, Neverquick, PhGustaf, Bubblebutike, Geodyde, Alexbot, PixelBot, Eekster, KC109, Pyroryan3, NiciVampireHeart, Cenarium, Tambridge, ChrisHodgesUK, Thingg, Aitias, Berean Hunter, DumZiBoT, Erin Brault, Ryan8374, XLinkBot, MarmotteNZ, Jovianeye, WikHead, NellieBly, Mm40, Wiki-Dao, Guyman1, Dubmill, Camoz87, Good Olfactory, EEEng, Addbot, Joghutton, Andrew from NC, Jncraton, Joe Parkmoor, Fluffernutter, Ashanda, Chamal N, Glane23, Chzz, Debresser, Favonian, CarTick, 5 albert square, Tide rolls, Lightbot, LuK3, Luckas-bot, Yobot, Kartano, Victoriaearle, Glenncheney, Magicpiano, Tempodivale, Jeremy706, AnomieBOT, Paulthomas2, Jim1138, Galoubet, JackieBot, Grolltech, Kingpin13, Mugginsx, MaterialsScientist, Citation bot, Donbribon, E2eamon, Bob Burkhardt, GrawnBot, Xqbot, Dartoe, Intelati, Ekwos, Capricorn42, Jw 193, Mononomic, Quark1005, Hachristina97, TRTitus, Gap9551, Srich32977, GrouchoBot, Mathonius, Amaury, Shadowjams, FrescoBot, LucienBOT, Paine Ellsworth, Sky Attacker, Skdin, Pfa alkemade, Cannolis, Solice kirk, Thefoetus, DigbyDalton, Pinethicket, Jonesey95, MJ94, Calmer Waters, A8UDI, Moonraker, Jschnur, Sds3aaph, SpaceFlight89, Curtis23, RazielZero, Kibi78704, Palexhaup, Utility Monster, DC, Kgrad, Trappist the monk, BaldBoris, Lotje, Vrenator, Zvn, Michael Jones jnr, Reaper Eternal, TheGrimReaper NS, Specs112, Diannaa, Zidaney5, Reach Out to the Truth, RjwilmsiBot, DexDor, Regancy42, Huntbug, Sam11333, Steve03Mills, John of Reading, Immunize, Hantsheroes, Look2See1, Shhnnotsoloud, RA0808, Kinghenrimck, Pzckser, Yunhyunmin, Gwillhickers, Ronswanson, Slightsmile, Tommy2010, Freddie22, Rancidgeorge, Savh, AvicBot, ZéroBot, PBS-AWB, Ida Shaw, Kmsenthooan, PsychoNiff, H3llBot, Ohskosh, SporkBot, Coddofwar, Wayne Slam, Yelkrab, Rcsprinter123, Τασοῦλα, IGeMiNix, Quantumor, MonoAV, Donner60, Teleutomyrmex, ClueBot NG, Alexcoldcasefan, Somedifferentstuff, NuketheMuslims, Burns1alex, O.Koslowski, Mannanan51, II NOBLE II, Helpful Pixie Bot, Calabe1992, Lizardfood, Lowercase sigmabot, XX1337AnonymousXx, Wiki13, Mark Arsten, Joydeep, Pandabears4life, Wikikikihaha bannannana, Gnosio, Klilidiplomus, Ilikepandasheart, Denvercoder9, Clfranklin1, MeanMotherJr, Awesomedude16, Taylordomenick, Missalena, Khazar2, EuroCarGT, Packer1028, Hmainsbot1, Webclient101, Mogism, Makecat-bot, TwoTwoHello, MattSucci, Geynea, Sexychick7, PrettyLLamas, Britnij, Jodosma, Zissou7, Rus793, Valetude, Ginsuloft, Atotalstranger, Grannier, Ithinkicahn, Xenxax, Blurryman, Monkbob, Tigercompanion25, Trackteur, Vanisheduser00348374562342, NotTheFakeJTP, Crito10, Barklerung, StBlark, Pam-javelin, Dilidor, JaneSwiftly, Robot psychiatrist, Bender the Bot and Anonymous: 659

- Miasma theory** *Source:* https://en.wikipedia.org/wiki/Miasma_theory?oldid=781627132 *Contributors:* The Anome, CatherineMunro, Julesd, RL, Charles Matthews, Irismeister, Wetman, Paul W, Yosri, Mervyn, Aetheling, Jpo, Gil Dawson, Fosse8, Noe, Paulscrawl, Kbrooks, Chrisbolt, Bender235, Cmdrjameson, Calan, Elipongo, Krellis, Wiki-uk, Zntrip, JBellis, Ashmoo, Deltabeignet, Cuchulain, BD2412, Seventh Holy Scripture, Rjwilmsi, DonSiano, Ligulem, Brighterorange, Who, Mathiastck, Nimur, Penguin, Hibana, Karch, Benlisquare, Rsrikanth05, Dialectric, Rjensen, Chevin, WILLY-MART, NetRoller 3D, SmackBot, Daviddavid, Hmains, Sadads, Lm-silva-enwiki, Lukrez-enwiki, Mike hayes, Scharks, DO11.10, Soap, Titus III, Khazar, Tazmaniacs, Peterlewis, Volatileacid, EdC-enwiki, Laddiebuck, Neelix, Calvero JP, PamD, Parsa, Headbomb, Txomin, Albany NY, Xeno, Cynwolfe, RockMFR, Ontarioboy, Knight of Ashtaka, The Big Eye, E2e3v6, HoseaZ, Quest for Truth, Yerpo, Hzh, Semitones, Martinlc, ImageRemovalBot, ClueBot, CasualObserver48, Dghemi, Pernambuko, GFHandel, Dave1185, Addbot, Martindo, Lightbot, Yobot, Ptbogourou, PMLawrence, Backslash Forwardslash, AnomieBOT, KDS4444, Yachtsman1, SnorlaxMonster, Šedý, FrescoBot, Feather Jonah, Hermione0826, Ale And Quail, CanaDanjl, PleaseStand, J36miles, EmausBot, John of Reading, Ntligent, Klbrain, Ornithikos, 'Ο οϊστρος, AManWithNoPlan, Bulwersator, Mcc1789, ClueBot NG, Gareth Griffith-Jones, OI-1.arrazola, BG19bot, Lo Ximiendo, Earlym.group1, Ericshinshin, Xflash96, MusikAnimal, Harizotoh9, Uberrnenschst, ChrisGualtieri, Esszet, Mdpacer, Little green rosetta, SteenthIWbot, 069952497a, Tom (LT), Bloghog23, Noyster, Opencooper, Hanif Al Husaini, The-Fat-Matt, EMsmile, ShreyaB94, Continentaleurope, Jimgrayzium, Mulvenea, Bender the Bot and Anonymous: 107
- Milieu control** *Source:* https://en.wikipedia.org/wiki/Milieu_control?oldid=740114415 *Contributors:* BRW, Jdcooper, Koavf, Hairy Dude, Malcolm, SmackBot, Johanneum, Cydebot, Alaibot, Astynax, Nick Number, MarshBot, PelleSmith, Maurice Carbonaro, Room429, JL-Bot, SummerWithMorons, Czarkoff, Borock, AnomieBOT, Kitfox, Meclee, Me, Myself, and I are Here and Anonymous: 7
- Military Assistance Command, Vietnam – Studies and Observations Group** *Source:* https://en.wikipedia.org/wiki/Military_Assistance_Command%2C_Vietnam_%E2%80%93_Studies_and_Observations_Group?oldid=736669533 *Contributors:* Ahoerstemeier, Fifelfoo, DocWatson42, Halda, Michael Devore, Btphelps, DragonflySixtyseven, Klemen Kocjancic, Gazpacho, Rich Farmbrough, Jarcnist, Bender235, CanisRufus, Kross, ThierryVignaud, Smoth 007, Woohookitty, Lapsed Pacifist, BD2412, Rjwilmsi, The wub, John Deas, Ground Zero, Nihiltres, Valentinian, Jaraalbe, Mysekurity, Wasted Time R, YurikBot, Elrith, Kirill Lokshin, BuffaloBob, Mhardcastle, SmackBot, Looper5920, YellowMonkey, Ominae, Chris the speller, Bduke, DHN-bot-enwiki, Jwillbur, OrphanBot, Hoof Hearted, Jbergquist, J.Christopher.Wells, Ohconfucius, Xdamr, Ergative rlt, Nkcs, Nobunaga24, Neddysagoon, Kevin W., MARK S., Rob1bureau, Cydebot, Hydraton31, Rifleman 82, Wikipediaregules2221, Canpark, Aldis90, Wandallstouring, Hcberkowitz, Waerloeg, TimVickers, RM Gillespie, Buckshot06, Jonf67, Catgut, Terjen, Cocytus, Raoulduke47, FlieGerFaUstMe262, Belissarius, CommonsDelinker, Nono64, Johnny542, FLJuJitsu, Jevansen, Xyl 54, Meyerj, DOHC Holiday, Tesscass, SlateGrey, Rootmoose, SieBot, Rosiestep, Monkinch, Jsf67, MenoBot, Sfan00 IMG, Cuprum17, Hatcher, Uncle Milt, Dr. B. R. Lang, Ed Moise, EpicDream86, MystBot, Addbot, Hermógenes Teixeira Pinto Filho, Reedmalloy, Azx2, Lightbot, CountryBot, Сергей Олегович, Yobot, Evans1982, BeBoldInEdits, Zpamaral, Chuckiesdad, Branxton, Srich32977, Obamiac, HoyaProff, Cod1337, ArdenHathaway, FrescoBot, Joep01, Sogknivescollectors, Trappist the monk, Tbotch, DASHBot, Mztourist, Look2See1, Distal24, Dewritech, Dcirovic, Illegitimate Barrister, Al83tito, Futureairman10, Intothatdarkness, ChuispastonBot, Palaeozoic99, Helpful Pixie Bot, Gob Lofa, Dainomite, Stumink, Creosota, TeriEmbrey, NotLessOrEqual and Anonymous: 50
- Mirepoix (cuisine)** *Source:* [https://en.wikipedia.org/wiki/Mirepoix_\(cuisine\)?oldid=764882487](https://en.wikipedia.org/wiki/Mirepoix_(cuisine)?oldid=764882487) *Contributors:* William Avery, Olivier, Edward, Fred Bauder, Jimfbleak, Loren Rosen, JonMoore, Lfh, Jlogloran, Zoicon5, Taxman, Wetman, Skybunny, Diderot, GreatWhiteNorth-erner, BenFrantzDale, Wwoods, Varlaam, Kpalion, Macrakis, Neilc, Bigpeteb, Burschik, Picapica, Grstain, Dr.frog, DanielCD, Hydrox, Bender235, Kwamikagami, Caeruleancentaure, Wadems, Gene Nygaard, Ghirlandajo, Emerson7, Ashmoo, Bunchofgrapes, Grammarbot, Nihiltres, Ben-w, YurikBot, Twin Bird, Plazman, Apokryltaros, Benzado, Biopresto, Tsk070, Maunus, MCB, SmackBot, ERcheck, Chris the speller, Cybercobra, AThing, Wavy G, Khazar, Ginkgo100, StuHarris, Woodshed, Vanisaac, Jerpeck, Captpackrat, Cydebot, Thijs!bot, Haleth, JAnDbot, Deflective, 100110100, Tmpafford, Murgh, DFS, Xb2u7Zjzc32, Proabivouac, Whitebox, Cadwaladr, Ontarioboy, STBotD, Seanbo, Aymath2, Gregogil, LeaveSleaves, AlleborgoBot, KrautKontrol, Bandreus, Pafufta816, Beemer69, Watermac, Drmies, Panapp, Alexbot, Coffee joe, Addbot, Faronem, Glane23, Jarble, Yobot, Yngvadottir, Mballen, AnomieBOT, Piano non troppo, MaterialsScientist, Obersachsebot, TinucherianBot II, Srich32977, FrescoBot, Gyroradius, AlexanderKaras, Slastic, MJ, Francophile124, Efficacious, Feo1337, Erianna, Manytexts, ClueBot NG, -sche, CopperSquare, Reify-tech, Helpful Pixie Bot, BG19bot, Pigup, La signora dei fornelli, Northamerica1000, YFdyh-bot, Wisdomthatiswoe, Lagoset, Monkbob, Ahriman2014, TantalusIX, Ifhish, Julietdeltalima, Caeciliusinhorto, IvanScrooge98, Spingshs, Bender the Bot and Anonymous: 90

- Mosaic (genetics)** *Source:* [https://en.wikipedia.org/wiki/Mosaic_\(genetics\)?oldid=780954392](https://en.wikipedia.org/wiki/Mosaic_(genetics)?oldid=780954392) *Contributors:* AxelBoldt, The Anome, Mrwojo, Tinc, Morwen, Pengo, Giftlite, Lupin, Jfdwolff, PDH, Vbs, Ukexpat, M1ss1ontomars2k4, MrTangent, Rich Farmbrough, Jonathan Drain, Bobo192, Michael James Boyle, Sommerfeld, AnnaP, Esparkhu, Gpvos, Gordon L, DSatz, Dryman, BerserkerBen, Woohookitty, Graham87, Rjwilmsi, Ppk80, Bgwhite, MalcolmGin, Chris Capoccia, Eleassar, Juicy fisheye, Sarefo, Mebden, SmackBot, RDBrown, George Church, Sadads, OrphanBot, TedE, Mikmd, AThing, Celefin, Qrc2006, Anthonyhcole, Javsav, Thijs!bot, KrakatoaKatie, Dougher, Rentaferret, TransControl, ZeroP, Nopira, LegendGamer, Lwollert, Mikael Häggström, L'Aquatique, PdcCook, Vikki1965, Rostowicz, Philip Trueman, Jimerama, Cloudswrest, McM.bot, Spiral5800, Doc James, Macdonald-ross, Lavajin, Mild Bill Hiccup, AirdishStraus, Nickersonl, Confused, Alexbot, DumZiBoT, Well-Read Red, Duncan, Miagirljmw14, Addbot, LatitudeBot, Cesiumfrog, Luckas-bot, Yobot, Citation bot, ArthurBot, Xqbot, YakbutterT, J04n, GrouchoBot, Omnipaedia, FrescoBot, D'ohBot, Haeinous, Citation bot 1, Jonesey95, Tom.Reding, RedBot, White Shadows, Kgrad, Double sharp, Cwbvb13, Amkilpatrick, ZéroBot, BG19bot, Achowat, BattyBot, Mogism, Ranze, Telfordbuck, Me, Myself, and I are Here, Mkeeslar, Sugardreadsmutt, Monkbob, Saumehsaeedi, Siyakamat and Anonymous: 54
- Most-wanted Iraqi playing cards** *Source:* https://en.wikipedia.org/wiki/Most-wanted_Iraqi_playing_cards?oldid=770572732 *Contributors:* Eloquence, Ed Poor, William Avery, SimonP, Dwheeler, Hephaestos, Rickyrab, Stevertigo, Patrick, Infrogmation, Michael Hardy, Oliver Pereira, Menchi, Geoffrey-enwiki, Paul A, Minesweeper, Ahoerstemeier, Stan Shebs, Docu, Kingturtle, Vzbs34, Nikai, Evercat, Efgihj, Samuel-enwiki, Robertkeller, Trainspotter-enwiki, Timwi, WhisperToMe, Furrykef, Rei, SH-enwiki, Pir, Branddobbbe, AlainV, DocWatson42, Mboverload, Klemen Kocjancic, D6, Rich Farmbrough, Florian Blaschke, Bletch, Tom, Jpgordon, Xevious, Miranche, Axl, Water Bottle, Garzo, Pethr, BDD, Dismas, Crosbiesmith, Stefanomione, Cuchullain, CronoDroid, Kbdank71, Rogerd, Syced, John Baez, Wingsandsword, Le Anh-Huy, Bgwhite, YurikBot, RussBot, Joshdboy, Brian1975, KDLarsen, ViperSnake151, SmackBot, Cla68, AndrewRT, LaWa-enwiki, Johnston49er, Bolivian Unicyclist, Cybercobra, Konangrit, Pats1, Vina-iwbot-enwiki, Ohconcius, Chaldean, Dr. Sunglasses, Robofish, Chris 42, The Man in Question, RHB, Tigey, Lord Anubis, Joseph Solis in Australia, BaghdadRummy, Noha307, Cydebot, Gogo Dodo, Barticus88, Biruitorul, PYLrulz, JRRobinson, Escarbot, Qa Plar, Coyets, Fermium, Niki2006, Sjukrow, KonstableBot, Bongwarrior, DerHexer, Robin S, Tracer9999, MartinBot, CommonsDelinker, Roman V. Odaisky, Fullmetal2887, Tiyoringo, Railwayfan2005, Bruno Rosta, KylieTastic, VolkovBot, EH101, Fran Rogers, Dj rizla, Kaiketsu, Logan, Ponyo, Fanra, Jack Merridew, A. Carty, Jdaloner, ImageRemovalBot, MBK004, ClueBot, Dustman15, Drmies, Subcelestial, WölffReik, Doriftu, XLinkBot, Addbot, Yakiv Gluck, Xaui, Eedlee, BadMoodTaylor, Pietrow, Yobot, Kjell Knudde, Horace150BC, Materialscientist, LilHelpa, Strich32977, Riotrocket8676, Green Cardamom, Pamdhiga, Trust Is All You Need, Meaghan, Lotje, Sumone10154, Elvis1977, RjwilmsiBot, Illegitimate Barrister, Ischium, Lokpest, Shane269, ClueBot NG, Mansmokingacigar, Aaronwayneodonahue, Widr, Vincelord, Srithikdatta, MrPenguin20, Floating Boat, BattyBot, Bestbackdigg, Bestqddigg, Zhoban, Memorex1987, Godsmann74, RaneMartin, Xxexvrrx, Bender the Bot and Anonymous: 120
- Multimarket contact** *Source:* https://en.wikipedia.org/wiki/Multimarket_contact?oldid=617443247 *Contributors:* Malcolm, Saberyn, Ser Amantio di Nicolao, Katharineamy, SchreiberBike, Addbot, Cf083687, DOI bot, Yobot, Citation bot 1, Jesse V., Citation-CleanerBot, DoctorKubla, Abakombe Tours and Monkbob
- Mushin (mental state)** *Source:* [https://en.wikipedia.org/wiki/Mushin_\(mental_state\)?oldid=783045824](https://en.wikipedia.org/wiki/Mushin_(mental_state)?oldid=783045824) *Contributors:* Nv8200pa, Quartertone, Nat Krause, Frencheigh, Andycjp, Dayg1110, Bumml3, Bendono, Viriditas, Daf, MPerel, SidP, RJFJR, Scriberius, Psiphim6, Apokrif, Marudubshinki, St33lbird, Bgwhite, Wavelength, Mushin, Weien, Shawnc, PREhse, Luk, SmackBot, Vvarkey, Bluebot, SkeenaR, Grasshoppa, CmdrObot, Cydebot, Macropneuma, Eu.stefan, Nemish, Barbro22, Bradford44, Mind meal, MacShimi, Leehach, The Last Melon, Kosigrim, SieBot, Mockingbus, Suomichris, RisingSunWiki, Hadrianheugh, Alexbot, Addbot, Luckas-bot, Yobot, AnomieBOT, Ciphers, Galoubet, D'ohBot, DC, Kontoreg, Robkelk, Adieu Achenkirch, Oakcroft, DeltoidNoob, K6ka, Daonguyen95, 30blatt, J.K.S.Lau, ClueBot NG, DARIO SEVERI, RayTayMiht, Helmholtz, Adriankocka12 and Anonymous: 31
- Mutual assured destruction** *Source:* https://en.wikipedia.org/wiki/Mutual_assured_destruction?oldid=783300715 *Contributors:* Mav, Bryan Derksen, The Anome, Eean, Ed Poor, Alex.tan, Andre Engels, Christopher Mahan, SimonP, Heron, Stevertigo, Edward, Lir, JohnOwens, Karada, Minesweeper, Goatsaur, CesarB, Ahoerstemeier, Docu, Julesd, Sir Paul, Rossami, GCarty, Mulad, Ventura, Dcoetzee, Pwd-enwiki, Jwrosenzweig, Wik, Zoicon5, Tinc, Maximus Rex, David Shay, Cabalamat, Masssivego, Pilaf-enwiki, Cvaneg, UninvitedCompany, Frish, Stargot, Chealer, Astronautics-enwiki, Korath, Securiger, Ojigiri-enwiki, Rhombus, Tobycat, Wikibot, Vfrickey, Guy Peters, Matflaschen, GreatWhiteNortherner, Alan Liefiting, David Gerard, DocWatson42, Jao, CrazyCanuck, Nadavspi, Levin, Fastfission, Bfnn, Snowdog, Chinasaur, Edcolins, JRR Trollkien, Abu badali, Quadell, Pembers, Mzajac, Yayay, Sohahto, Cesar-Felipe, Erann, Crazyeddie, Urhixidur, Karl Dickman, Kingal86, Nimbunan, SkArcher, MCBastos, Rama, Vsmith, ArnoldReinhold, Smyth, Kooo, Paul August, Gronky, Bender235, Breon, JoeSmack, J-Star, Kwamikagami, CJWilly, Shanes, Alberto Orlandini, Maureen, Redquark, Daf, Obradovic Goran, Lysdexia, Nexus says, Danski14, Alansohn, Gargaj, Atlant, Hipocrite, Wtmitchell, Tainted-Mustard, DV8 2XL, Axeman89, Komodo-enwiki, Stemonitis, Dr Gangrene, Firsfron, Billhpke, Woohookitty, AirBa-enwiki, Jleon, TreveX, GregorB, Randy2063, Preisler, L., Ajshn, Rejnal, Ashmoo, Graham87, Marskell, Crzrussian, Rjwilmsi, Isaac Rabinovitch, Vary, Staecker, Quietust, FlaBot, Ground Zero, JYUyang, Rex186, Nimur, K, Srleffler, Dvdm, Ajhpook, Adoniscik, YurikBot, Jimp, Araado, Zafiroblue05, Hede2000, Gaius Cornelius, Guslto, -OOPSIE-, Thiseye, Ragesoss, Froth, WayneC, Lockesdonkey, Enormousdude, Teiladnam, Arthur Rubin, JQF, Downward machine, I-2-d2, Dmuth, Andrews, CKelly, Dariopy, GrinBot-enwiki, Patiawat, SmackBot, John Lunney, Hux, Martylunsford, Gjs238, Gilliam, Hmains, Jushi, Kevinalewis, Qwasty, Jprg1966, Thumperward, SB Johnny, Colonies Chris, Can't sleep, clown will eat me, Lazar Taxon, Rrburke, Feenix-enwiki, Stevenmitchell, Jmlk17, Wen D House, EVula, PsychoJosh, BullRangifer, WhosAsking, Jonatanj, Deepred6502, Wafwot, Eliyak, Heather, John, Pat Payne, Kcatz, Hvn0413, Optakeover, Maestlin, Joseph Solis in Australia, Tony Fox, Johnnyde, Civil Engineer III, Dkastner, Ihavenoheroes, Raystorm, ERAGON, CmdrObot, Flambelle, Vints, Avillia, Liu Bei, Maxrandom777, Hemlock Martinis, Cydebot, Marqued, Myscrnm, CMarshall, Krator, NorthernThunder, Dimo414, Mombas, Thijs!bot, Robsinden, Qwyxian, Fisharmor, Wombdpsw, Memty Bot, Keraunos, Parsiferon, Brianmarx, Drunkill, Oreo Priest, Zfishwiki, Csaavedra71, Hires an editor, Radimvice, Carolmoored, Jim whitson, Scopia, One Artiste, Gdo01, Dreaded Wreus, Ingolfson, JAnDbot, Struthious Bandersnatch, Repku, Magioladitis, Guzenkov, Kakaze-enwiki, JamesBWatson, Cadsuane Melaidhrin, Caroldermoid, Rich257, Jackthesmack, VegKilla, Cgingold, 28421u2232nfencenc, Mattinbgn, Commons-Delinker, Fconaway, Thirddright, J.delanoy, Hotsick, AstroHurricane001, Maurice Carbonaro, Thaurisil, Ian.thomson, Century0, Shawn in Montreal, Ash sul, Colchicum, Xgretsch, Ziqidel, Bawlix, WinterSpw, Cs302b, Phr0gor, Idioma-bot, VolkovBot, Morenooso, Johnfos, ABF, Klausdog, Sp3z1aL, Jacroe, Philip Trueman, TXiKiBot, Rollo44, Toll booth, Ddelestrac, Chris-marsh-usa, Death Star III, Reibot, JhsBot, Supertask, ^demonBot2, Valentein, Ryanweb, PaladinWhite, Rdfox 76, B. Jennings Perry, Larklight, Pribar, Theclarks, Nonprowonk, NPguy, Nstott, SieBot, TJRC, Stoikheionainos, Andrewjlockley, A.shteiman, RucasHost, Techman224, Shoombooly, N c 9, MBK004, ClueBot, Binksternet, MoCellMan, The Thing That Should Not Be, Chiefy33, Der Golem, VQuakr, Ryououtou, El-livville-enwiki, On Thermonuclear War, Jusdafax, LeonardBloom, Estirabot, USA92, Saebjorn, Kakofonous, Jellyfish dave, Versus22, NERIC-Security, Jachymov, Little Mountain 5, TravisAF, Addbot, Xyphy, Some jerk on the Internet, Rockreader, CanadianLinuxUser,

MrOllie, SoSaysChappy, AnnaFrance, Kyle1278, Terrillja, Tassedethe, Krano, Zorrobot, Jarble, LuK3, Genius101, Yobot, AnomieBOT, Jim1138, Bruce Campbell, MaterialsScientist, Brightgalrs, TinucherianBot II, Badenr, J04n, Nasa-verve, Mark Schierbecker, RibotBOT, AlphaRed3, INeverCry, Lukeroge, Learner001, Lithenium, FrescoBot, Paine Ellsworth, Rotideypoc41352, Bagelofdoom, BenzolBot, Gesalbt, Pksloan, Jonesey95, Stephen bashkir.234, Brucewh, Serols, Pristino, Orenburg1, Mjs1991, January, Theo10011, Reach Out to the Truth, Hajatvrc, Smosherga, 达伟, EmausBot, WikitanvirBot, Boundarylayer, Wikipelli, K6ka, Tanner Swett, Fæ, Armandas j, Ischium, SporkBot, Mipsicologo, Mentibot, Ace of Raves, Whoop whoop pull up, Troyonto, ClueBot NG, Queman77, Joefromrandb, Frijtes, Lekrecteurmasque, TootsMcGee, MillingMachine, Helpful Pixie Bot, Regulov, BG19bot, Piguy101, Mdy66, Tratchy, Uchaschiysya, David12345, BattyBot, Purdygb, Mogism, AldezD, Tcpretzel, Jess97mc, Madreterra, Wuerzele, Infamous Castle, Supersaiyen312, Chris troutman, A Certain Lack of Grandeur, Monochrome Monitor, Nigellwh, Asm20, Abattoir666, Scimonster, Weslam123, Monkbot, Lucascjohansson, Liberivore, SmartHunter1, Tittsmcgee8, Garfield Garfield, Nicky mathew, Julietdeltalima, Nemeclnemecl, Felis Lacertilia, Timothyjosephwood, Compassionate727, Katharos.hilaris, Tolgraven, Matterington, Gary Dahl, Maxaxax, Lafcadio99, KGirlTrucker81, Robot psychiatrist, Motivação, Jebz10 and Anonymous: 489

- Neutering** *Source:* <https://en.wikipedia.org/wiki/Neutering?oldid=783068689> *Contributors:* Toby Bartels, Timwi, Kowey, Auric, Chowbok, Pgan002, Andycjp, Heegoop, Crxssi, Wefa, Bender235, Jpgordon, Bobo192, Polylerus, Gary, SidP, Docboat, Dan East, Tmrobertson, Graham87, Rjwilmsi, NekoFever, Strait, Bensin, Ewlyahoom, Jrtayloriv, Idaltu, DVdm, Chris Capoccia, Gaius Cornelius, Anomalocaris, Anomie, Dforest, DRosenbach, Speedoflight, SMCandlish, Waterspyder, A Doon, SmackBot, Gsdlova, Anastrophe, Arny, Gjs238, Gilliam, Cs-wolves, Cgoodwin, Thom2002, Persian Poet Gal, Thumperward, Heymon32, Colonies Chris, Scwlong, Cripipiper, Snowmanradio, Hoof Hearted, Pwjb, Jóna Þórunn, Rissas, TenPoundHammer, Joelmills, Optimale, George The Dragon, Dr.K., Dodo bird, Robin Chen, DI2000, Dragix, NativeForeigner, PaddyM, Paulkaye, ShelfSkewed, Penbat, Reywas92, Gogo Dodo, Skittleys, Lowellt, Renamed user 7501825804, Headbomb, Seaphoto, MsDivagin, Scepia, Braindrain0000, Opendestiny, Steveprutz, Acroterion, Carlwev, JamesBWatson, Mclay1, Tedickey, Ed!, Inhumandecency, PhageRules1, MezzoMezzo, Jeepday, Gabr-el, (jarbarf), Parasane, DH85868993, Squids and Chips, CardinalDan, ABF, Ryan032, Cú Faol, Toll booth, Una Smith, Lradrama, Thunderbuckram, Animallover5050, Dooftotch, Treacle07, Ultimaniahk, Whiskey in the Jar, Faits, GlassCobra, Bob98133, Mckenzievmd, Bagatelle, Naima.fatimi, Dlh-stablelights, ClueBot, Chrain, Awesomebitch, Arakunem, Drmies, Mild Bill Hiccup, Canine caretaker, Boing! said Zebedee, Afru, Neverquick, Sardog1, Theroguex, Rg0057, Ginbot86, DumZiBoT, Johnmackoh, Dthomsen8, Dogwhisperer16, Mitch Ames, Zodon, Nimptsch, Thatguyflint, Addbot, DOI bot, Sanorris77, DugganB, Ronhjones, Gruntlord6e, CanadianLinuxUser, Kyle1278, Tyw7, Jarble, Cream horn, Hair4U, Kilom691, Mardeg, Gobbleswogger, AmeliaIsland, AnomieBOT, DemocraticLuntz, Captain Quirk, Jim1138, Scuzzler, Ulric1313, Jmcollier, MaterialsScientist, Citation bot, Clark89, Zad68, Bullmad43, Srich32977, Prunesqualer, FrescoBot, Weetoddid, Onjacktalluca, Citation bot 1, Pinethicket, Tom.Reding, Optimus2g, Gulbenk, RjwilmsiBot, John of Reading, Gfoley4, Dewritech, Yt95, GoingBatty, Anirluph, H3llBot, Unreal7, Liannadavis, Donner60, Kmva, Whoop whoop pull up, ClueBot NG, SureJohn, Frijtes, Egg Centric, Ramaksoud2000, BG19bot, Writ Keeper, Fylbecatulous, Cry884, Cyberbot II, Deathlasersonline, Dexbot, ALH, Cerabot-enwiki, Driodmen, Lugia2453, ServantofAllah93, Bluefoxstudio, Ekip39, Karenfisk, DavidLeighEllis, CensoredScribe, Camio732, Attenuasis, Chrismorey, Fafnir1, Monkbot, Superhaystack, Smallfri789, EoRdE6, Julietdeltalima, Fimatic, SPay Pal, PeachSauce, White Arabian Filly, Electrofunyun, Aayandre1965, GreenC bot, DferDaisy, Raccif, Fiamtz, Nseller420, O-Quatangin-Wann 2015 and Anonymous: 269
- New World culture** *Source:* https://en.wikipedia.org/wiki/New_World_culture?oldid=782170518 *Contributors:* D, BrianHansen-enwiki, Shyamal, Tannin, Jimfbleak, Muriel Gottrop-enwiki, DaMatriX, Tjunier, Tpbardbury, JohnCastle, RedWolf, Naddy, Smallweed, Radomil, Wikibot, GerardM, JerryFriedman, Abigail-II, Rick Block, Karol Langner, DanielCD, Rich Farmbrough, Mwng, Bender235, Dgorsline, El C, Circeus, Phyzome, HasharBot-enwiki, Sabine's Sunbird, Axl, Dinoguy2, Stemonitis, DanHobley, Coneslayer, Rjwilmsi, ErikHaugen, FlaBot, Eubot, Nihiltres, Gdrbot, Bgwhite, YurikBot, RobotE, Dymorodrepanis-enwiki, Apokryltaros, Lockesdonkey, SmackBot, KnowledgeOfSelf, Eskimbot, Droll, Gruz, Abyssal, Alphathon, Snowmanradio, Wizardman, Metamagician3000, Thor Dockweiler, Kevin, Mr Stephen, Amdurbin, FerranGil, Amotis, Lavateraguy, Metanoid, GeeOh, Thijs!bot, Escarbot, Arch dove, Natureguy1980, Vultur-enwiki, Maias, Trapezoidal, anacondabot, WolfmanSF, Branka France, Peter coxhead, Rufous-crowned Sparrow, Chiswick Chap, Trilobitealive, Jmrowland, Carolegr, Rei-bot, Sandhillcrane, JhsBot, Király-Seth, Hey jude, don't let me down, 4444hhhh, AlleborgoBot, SieBot, Calliopejen1, VVVBot, MeegsC, JabbaTheBot, LeadSongDog, Mar(c), FunkMonk, Fresnobatlady, Mimihihitam, Lightmouse, Rocksandirt, COnanPayne, GngstrMNKY, Little Mountain 5, Addbot, Kisbesbot, Romanskolduns, Zorrobot, Laikayiu, Lucas-bot, Yobot, Meotrandgen, Vini 17bot5, AnomieBOT, MaterialsScientist, Diucón, Eumolpo, ArthurBot, Xqbot, Anna Frodesiak, GrouchoBot, Evanphoto, RibotBOT, LucienBOT, Gouerouz, Tom.Reding, Jauhienij, KnowledgeRequire, FoxBot, EmausBot, Look2See1, Wesley J M, HiW-Bot, Medeis, Whoop whoop pull up, ClueBot NG, Helpful Pixie Bot, Ornithodiez, NotWith, السيف ذو الوشاح, Dexbot, Rainbow Shifter, Ryan Hodnett, HaugenErik, Sbarrolola, Wuerzele, Pokechu22, Robevans123, ColRad85, Monkbot, Chewbakadog, Bender the Bot and Anonymous: 43
- NIMBY** *Source:* <https://en.wikipedia.org/wiki/NIMBY?oldid=783600842> *Contributors:* Ed Poor, Verloren, Tillwe, Dante Alighieri, Andres, GCarty, Dysprosia, Bhuston, Tempshill, AnonMoos, Wetman, Jason M, Slawojarek, Darkcore, Robbot, Sdedeo, Meelar, Wikibot, TPK, Xanzzibar, Wayland, Pengo, Alan Lifting, Orangemike, AngelHedgie, Everyking, Andycjp, Quarl, Tsemii, Pinnerup, Rich Farmbrough, Sladen, FT2, MarkDilley, Vsmith, David Schaich, Bender235, Sketch, Welshie, Coolcaesar, Erath, Func, Reinyday, Vortexrealm, Richi, TMS63112, Pearle, Joolz, Andrewpmk, Velella, ProhibitOnions, Ramk13, Tony Sidaway, Cskin, Boothy443, Daniel Case, Armando, Hotshot977, Dmountain, BD2412, Rjwilmsi, Quiddity, Vegaswikian, ScottJ, MarnetteD, Leslie Mateus, Chobot, Benjamin Gatti, Bgwhite, Simesa, YurikBot, SWalkerTTU, Wavelength, Sceptre, Gaius Cornelius, Neilbeach, PaulGarner, ENeville, Doctor Whom, Aeusoes1, Biopresto, Black Falcon, Tonywalton, 2fort5r, Antonym-enwiki, Bobwinmill, Allens, Jonathan.s.kt, NeilN, SmackBot, InverseHypercube, McGeddon, Alksub, Eskimbot, Castellanet, Canthusus, Gjs238, Nil Einne, Edgar181, Chris the speller, SynergyBlades, Cadmium, Mattythwhite, Delink, Nixegale, Thisisbossi, Rrburke, BIL, Oanabay04, The PIPE, Xeno666, Kendrick7, Salmonforgey, Loodog, Gobonobo, Grumpyyoungman01, Aribbans@yahoo.co.uk, TastyPoutine, DI2000, Hu12, Ewulp, Courcelles, Jtowns, Yinchongding, Explodingsun, Hezbolarki Fun Ship, Banedon, Jonecunn, Fitzaubrey, Lentower, Karenjc, Cydebot, Samuel, Gogo Dodo, Hebrides, Quibik, DumbBOT, Teratormis, Underpants, Mfko, Rocket000, Thijs!bot, JAF1970, Bobblehead, James086, Itsmejudith, The Person Who Is Strange, AntiVandalBot, RobotG, Whogue, Prolog, Tjmayerinsf, Smartse, Ingolfson, Albany NY, OhanaUnited, Acroterion, Magioladitis, Bongwarrior, Unak78, WhatamIdoing, Theroadislong, Frotz, PaulAndrewAnderson, Drm310, MarkBA-enwiki, Smilingsuzy, Verdatum, Vi2, Mike.lifeguard, Metrax, MTLskyline, Xercssthgreat, Athene ancicularia, ShambhalaFestival, Ordeith, Hellno2, Thedjatclubrock, Johnfos, Wcrosbie, Oshwah, CaGeRaGe, Cmonday, Plr4ever, Broadbot, UnitedState-sian, Bearian, Malick78, Ethel the aardvark, Michael Frind, GoddersUK, SieBot, SuzannaQ, Eternal dragon, Cinebar, JenniferHeartsU, Invertzoo, ClueBot, Wysprgr2005, Ted19, Niceguyedc, Neozoon, Pointillist, No such user, Alexbot, Lartoven, Millionsandbillions, 4-409r-0, Nobody of Consequence, Tony Holkham, Anywikiuser, Qwfp, Alevy1234, XLinkBot, DSoup, Robinlobb, Tool2Die4, Addbot, Freakmighty, Youre dreaming eh?, Misterx2000, Nationalthe, My15minutes, OIEnglish, Lucas-bot, Yobot, Playclever, AnomieBOT,

IRP, Gogowood, Crecy99, MaterialsScientist, Hunnjazal, Loktkey, LilHelpa, FrescoBot, HRHThePrinceIII, Katecs, Redrose64, ShadowRangerRIT, Nmatavka, Pjslevin, LittleWink, Half price, Skol fir, RedBot, MastiBot, Cnwiliams, Elekh, Orenburg1, Concerned-Vancouverite, Train2104, Lotje, Ammodramus, Offwo200, Onel5969, RjwilmsiBot, DexDor, Grizzlyskaol, Thedofc, Emmypantin, John of Reading, MMPinkRanger, BruceSwanson, Winner 42, AsceticRose, Jasonanaggie, Osomooore, Zezen, AManWithNoPlan, Wingman417, Leendert123, Kindzmarauli, Wipenade, ChuispastonBot, BulbaThor, Sven Manguard, CharlieEchoTango, Resplin.odell, ClueBot NG, MelbourneStar, Catlemur, GeTAboozE, Frig 45, Jippijip, Nimbysep, Frietjes, Larrycarlsonjr, Helpful Pixie Bot, WingsOnceBot, Plantdrew, BG19bot, Ymblanter, The Mark of the Beast, Northamerica1000, T-Nod, Schmooble, Mycosys, Bengt-Inge Larsson, David.moreno72, ThunderingTyphoons!, Fishcake159, MarcusPearl95, IsraphelMac, Alfreddw, The Quirky Kitty, Wywin, GabeIglesia, Epicgenius, Shellystripes, DanielEditsThings, Kayleigh.herberson, Malcolmmwa, Wimbledon2014, Monkbob, Plokmijnuhbygtvfdx-eszwaq, Design43, Marcohey, Pariah24, ScrapIronIV, Hobbitchuster, Jamb76, Firebrace, Steward91, WPTBR, Qzd, Tomstar crunch, Bender the Bot, Tony11978 and Anonymous: 283

- OODA loop** Source: https://en.wikipedia.org/wiki/OODA_loop?oldid=780287885 Contributors: Mrwojo, Ronz, Patrick0Moran, Wernher, Secretlondon, Phil Boswell, Dmn, DocWatson42, Joelm, Urhixidur, Kim ㄹ, Mike Capp, Keno, Viriditas, Espoo, Gary, PaulHanson, Ashley Pomeroy, TaintedMustard, Alai, Daranz, Ernst.schnell, Stefanomione, Mandarax, Wolfdancer, JubalHarshaw, KAM, Ian Pitchford, Mahlon, YurikBot, Hydrargyrum, Gaius Cornelius, Juanpdp, TLSuda, SmackBot, Hmains, Bluebot, Jprg1966, Thumperward, Delink, Frap, Michael Rogers, Ohconfucius, Vgy7ujm, Beetstra, Meco, Kencf0618, Victoriagirl, Warrenfish, Yaris678, Aflewis, Bornsommer, Brad101, Thijs!bot, OtterSmith, Peter Harriman, Trusilver, Mrg3105, Ndunruh, Burzmali, Kyle the bot, Davidullman, Oldpilot, Wuffnozzle, Showers3, Sanya3, Phillipsmcgee, Binksternet, Kendo70133, Tomas e, Tswicegood, Alexbot, Nuiloa, SilvonenBot, Kbdankbot, Addbot, Jafeluv, Luckas-bot, MBorghese, Sweerek, Maven111, MaterialsScientist, FrescoBot, Beanyandcecil, DexDor, Beyond My Ken, Aetius41, ZeroBot, ClueBot NG, Oodaloops, Biogeographist, Al Tunes, InternetArchiveBot, GreenC bot, Aliquis incognitus and Anonymous: 54
- Ramayana** Source: <https://en.wikipedia.org/wiki/Ramayana?oldid=783526334> Contributors: Arvindn, Hari, Youandme, Vik-Thor, Paul Barlow, DopefishJustin, Yann, Ihcoyc, Mkweise, Ellywa, Gyan, Emperor, Kaysov, Vivin, Pizza Puzzle, HariPrasad-enwiki, Agtx, Charles Matthews, Wik, TpbBradbury, Imc, Bhuston, Carol Fenijn, Mowgli-enwiki, Anupamsr, Flockmeal, JorgeGG, Carlrossuarez46, RedWolf, Goethean, Peak, Modulatum, Chancemill, Lowellian, Shash, Hidoshi, Whoami-enwiki, Hemanshu, Rrjanbiah, Hadal, Davidcannon, Xyzzyva, Crcluvr, Graeme Bartlett, Andries, Fennec, Meursault2004, Orpheus, Everyking, Varlaam, Catchanil, Mboverload, Kukkurovaca, Utcursch, LordSimonofShropshire, Dvavasour, Zeimusu, Heman, Tothebarricades.tk, AmarChandra, Didactohedron, WhiteCrow-enwiki, Adashiel, Flex, Sebrenner, Venu62, Macrowiz, Chaipau, Discospinster, Spundun, Florian Blaschke, Dbachmann, Bender235, Alren, Kwamikagami, Art LaPella, Alxndr, Bobo192, Rramphal, HPN, Duk, Cmdrjameson, SpeedyGonsales, Kbir1, Hinthia, MPerel, Kushal, Ogress, HasharBot-enwiki, Aitch Eye, Papertree, Ranveig, Jumbuck, Raj2004, Cma, Anthony Appleyard, Wiki-uk, Ricky81682, Riana, Cdc, Eukesh, Mysdaao, Kesh, Uucp, Lerdswa, Kaushik twin, Sfacets, Axeman89, HGB, Tintin1107, Japanese Searobin, Sashazlv, MongolianMoose, Velho, Kelly Martin, OwenX, Woohookitty, Brhaspati, Shreevatsa, Georgia guy, Ernst.schnell, Ganeshk, Plumcouch, Tabletop, Dangerous-Boy, Prater-enwiki, Stevey7788, Raguks, BD2412, Pranathi, Grammarbot, Tloche, Rjwilmsi, Agrumer, Pleiotrop3, NikNovi, Wikirao, TheRingess, Bhadani, Trisdee, Fish and karate, Ravidreams, FlaBot, Spudtater, Gurch, TeaDrinker, Balakrishna, Chobot, DaGizza, K2wiki, DVdm, Bgwhite, Shomat, Skoosh, Adoniscik, Uriah923, Daduzi, YurikBot, Wavelength, Deeptrivia, RussBot, Indoloony, Musicpvm, Mark Ironie, Techraj, Tenebrae, Gaius Cornelius, CambridgeBayWeather, TheMandarin, Shanel, NawlinWiki, Rohitbd, Dialectric, Badagnani, AKeen, Biggymo6, Welsh, Howcheng, Daniel Bonniot de Ruisselet, Caiyu, Mithunc, Vastu, Zwobot, Srikrishnak, Chandroos, Priyanath, Wujastyk, Caerwine, Deepak-enwiki, Lokesh 2000, Smaines, Ms2ger, Crisco 1492, Doldrums, J S Ayer, Rudrasharman, PhillyCheese, Chopper Dave, Closedmouth, Raamesh, Shyam, Draxible, Tyrenius, Anclation-enwiki, Pratheep, GrinBot-enwiki, Tom Morris, FieryPhoenix, SmackBot, Imz, Bolasanibk, Reedy, TracerBul-let, Martin.Budden, C.Fred, Bomac, Jagged 85, Bwithh, Underwater, David G Brault, Oneilorisit, Srkris, Sundaryourfriend, Gilliam, Ohnoitsjamie, Hmains, Holy Ganga, Schmittey, Madmedea-enwiki, B00P, Jeysaba, Vsiddharth, Droll, Rjmond, DHN-bot-enwiki, Hongooi, John Reaves, Sachinpapa2000, Rama's Arrow, Vaayuvaan, Royboycrashfan, Tsca.bot, Can't sleep, clown will eat me, HoodedMan, RProgrammer, Chlewbob, Beta.s2ph, Astrobhauria-enwiki, Lapisphil, Cribananda, Jwy, Iksvaku, Dreadstar, Mattut, Wikifan1248, Mlpkr, GameKeeper, Ananthp, Andrew Dalby, Ohconfucius, Krawat, Paul 012, Victor D, SashatoBot, Rerere12, Pizzadeliv-eryboy, Carnby, Srays, PachyPachy, Sreekanth, JohnI, Nygdan, Ravimetre, Yogesh Khandke, RandomCritic, Abhishek-Kumar, Argotechnica, Kewltodamax, Uhanu, Harishyam81, Optakeover, Mountainmage, Ambuj.Saxena, MTSBot-enwiki, DI2000, Hu12, Jijithnr, Kaushik feluda, JoeBot, Bsskchaitanya, Splitpeasoup, Bharatveer, Shreekar, Nobleagle, Dan1679, Hibernophile, Krohon, FatalError, Jpxt2000, KNM, KyleGardiner, CmdrObot, Rajat Ghai, Mik0930, Madspiritmaster, Drinibot, Banedon, ChessMan007, Godardesque, Richard Keatinge, Unmitigated Success, M G Harish, Icarus of old, Jac16888, Cydebot, Whizkidravi, Subravenkat, Chhajjusandeep, Cunningham, MC10, Aristophanes68, Meno25, Rjayender, Hebrides, WikiWikiMan, Arun athmanathan, Adityarn, Viscious81, Sfly510, Doug Weller, Christian75, Atulpj, DBaba, Gimmetrow, Vkvora2001, S raghu20, הרררר, The Raven's Apprentice, Jnmansai, Thijs!bot, Eprb123, Parsa, Peter.M.D., ArjunNair, Wakantanka, Syedfazel, N5iln, John254, Astynax, Tocharianne, WhaleyTim, Tejshas, Escarbot, Igorwindsor-enwiki, I already forgot, AntiVandalBot, Feyenatic london, Sudhirkbhargava, Vajagenji, Modernist, Korvan, Naveen Sankar, Indian Chronicles, Wahabijaz, Phil153, JanDbot, Xhienne, Ekabhishek, Barek, Bakasuprman, Dsp13, Quentart-enwiki, KuwarOnline, Leolaursen, PhilKnight, Steveprutz, Magioladitis, Atomsf, Dexteratmd, Transcendence, Camhusmj38, SYLFan74, Kajasudhakarakababu, Sindhutvavadin, Rich257, Rugops, Balloonguy, Presearch, Indon, Kmslsb, Mahitgar, Animum, Tuncrypt, Eldumpo, Allstarecho, Dharmadhyaksha, DerHexer, Ekotkie, J mareeswaran, MartinBot, Rhino131, Arjun01, Kiore, Rodan44, R'n'B, Commons-Delinker, Steve98052, Gunkarta, Hairchrm, Fconaway, Nekospecial, EdBever, Gnanapiti, Danpetitpas, J.delanoy, Abecedare, Trusilver, Adavidb, Maurice Carbonaro, Tokyogirl79, Mark Froelich, Johnbod, Ncmvocalist, MickeyTheWiki, DarwinPeacock, Krishnachandranvn, Robertson-Glasgow, PShukla, Sathiam, Richard D. LeCour, Zerokitsune, DadaNeem, SJP, Rumilofaniel, Sanscrit1234, Morinae, Kanakaraju, DorganBot, Akut, Idioma-bot, Redtigerxyz, Signalhead, VolkovBot, MrNeutronSF, GaganAdi, Ab.arun, Fluffybun, Oshwah, Mercurywoodrose, GOC-in-C, Technopat, Monkey Bounce, Britsin, Darz kkg, Martin451, Matahari Pagi, Buddhipriya, Ajay259, Amog, Sloth039, Rameez, The dog2, Cantiorix, Teh roflmaoer, Falcon8765, Enviroboy, Tonkun, Joglekar, Mohonu, Isis07, EmxBot, Smurali49, Arjun024, Ponyo, SieBot, BalanceRestored, Hulagu, Scarian, Oldag07, Ridi Faruque, Justindlc, Flyer22 Reborn, Yerpo, Oxymoron83, AngelOfSadness, Goustien, BenoniBot-enwiki, Sunrise, Gwendeloy, Suyashmanjul, Jacob.jose, Raidako-enwiki, Neo., Varanwal, Philwink, Denisarona, Randy Kryn, 3rdAlcove, Greenknight21, Janvi.sharma, Mx. Granger, RegentsPark, Loren.wilton, Sfan00 IMG, ClueBot, Bobbyque2004, ConstantineChernabog, Helenabella, Tinkubell, Dmies, Der Golem, Parikhjigish, Gaurav.nirvana, Rakeshsumit, Boing! said Zebdede, Truthseeker81, Chmanojo8, StigBot, Shovon76, Trivialist, RainDew, Arunsingh16, Alexbot, Japuralwis, Sarojraj, MartinDiMaggio, Jturner75, Ryker321, NuclearWarfare, Arjayay, Promethean, Insistentbeauty, Nvvchar, Levent, Schreiber-Bike, ChrisHodgesUK, Friedlibend und tapfer, Heartheram, Apparition11, Wnt, Wikidas, Rossen4, DumZiBoT, Roshangjha, BarretB, RustDragon, XLinkBot, Gunthard Mueller, Kannan91, Bohdanmaks, Tjco74, Aswathr, BodhisattvaBot, Mitsube, Cminard, Goposky, PRIYANKA VISHWAKARMA, Kotakkasut, WikHead, Ism schism, SilvonenBot, Engsamnang, MystBot, Mukeshraj, Ganesh

tripathi, Gourav2711, Addbot, Samira 2008, Srikantorahman, C6541, Some jerk on the Internet, Tanhabot, Ronhjones, Shashank.bishnoi, Fluffernutter, Download, Writesprincesswiki, Jonoikobangali, Devadatta, Tassedethe, Numbo3-bot, Halaster, Mark lecras lover, VP-bot, Luckas-bot, Yobot, Kartano, Fraggie81, Eeriya, Mhamiaa, AnakngAraw, Maldek2, Ed510, AnomieBOT, Jim1138, Adelle-frank, Mann jess, Bens2008, MaterialsScientist, ادريس فانتح, Sarbeswar.meher, Citation bot, Boedawgyi, Bob Burkhardt, Star reborn, Bezel664, LilHelpa, Suasysar, Xqbot, Beardfrun, The Banner, Engineering Guy, Eva in philosophy, Satyask, Satyam2000, MarkWarren, Srich32977, Omnipaedista, RibotBOT, Opfallon, Amaury, Eugene-elgato, WhisperOfTheWind007, MarkkuP, Bauddha, FrescoBot, Aerospice, Amrutabhav, Xophist, Aaroohii, InspectorSands, Achshar, MGA73bot, Yanajin33, Sandy9722003, Kenfyre, Amitvaze316, Parija.alok, Eronel189, Atlantia, Citation bot 1, Wandering-teacher, DrillBot, SpacemanSpiff, I dream of horses, LittleWink, Jonesey95, Calmer Waters, Dazedbythebell, Skyerise, Hannibal, Serols, Jcc, Ashmrcool, Imjitin, December21st2012Freak, FoxBot, To-beBot, Ndajani, Lotje, Blueocean, Aoidh, Prasob N, Ilham Jenor, Avedeus, DARTH SIDIOUS 2, Notonegoro, Suraj845, RjwilmsiBot, Bento00, Rkkrajara, Ripchip Bot, RAMA, EmausBot, John of Reading, Acather96, WikitanvirBot, Deepakagg, Wizzythekid2, Gbur-bano, GoingBatty, SteveM123, Chhikara, Kashikar, Thomasionus, Lostinindia, Wikipelli, Dcirovic, TeleComNasSprVen, AsceticRose, Dvnaveen, PraShree, Kkm010, MorbidEntree, Ab600, Ravitejainv, Ganesh Paudel, Midas02, AISHWARYA ARUN KUMAR, Mgs-effner, Jonathansammy, Ishvanya, AndrewOne, The Alzabo, Abhiramajithlink, TyA, Pfrost9, Bokuwakuyu, 11 Arlington, Gsarwa, JuTa, Sank123s, ChuispastonBot, Weirdivideos, Theismcontrib, Abhishekmtbm, Lovelit, Neil P. Quinn, TYelliot, Vargaslosachange, ClueBot NG, Vrv 1964, Gareth Griffith-Jones, Ronakshah1990, NKul, Divyakaushik134, Kakanisantosh, Hawa-Ave, Uwo222, Rank Penguin, Floatjon, Greatchenna, Rgimvl, Rooneywayne17, Cntras, Braincricket, Dream of Nyx, Rajubh, Widr, SHIDHAR7, Mayankwadhwa, Narayana.raghavendra, Mitesh1082, Helpful Pixie Bot, Tejasunku, Summer radish, Beecher70, Titodutta, Kailash29792, Kpbolumbu, Varadarajd, Arunha, BG19bot, MKar, Sugram, Ghanendra K Nath, Sandy13991, PhnomPencil, Frze, Bhavinkundaliya, HMMHunt, Gorthian, T.W.Fernandez, Soerfm, Ambaji, Anantagati, BharatNN, Sarada14, DPL bot, Risingstar12, Jayadevp13, Achowat, Wannabemodel, Ramayana sanskrit, Rpaigu, SatyamMithya, BattyBot, Noyanika, Arjunbalassery, Trini1988, Krishna P Bhandari, GautamNitish, Subhasis Chakraborti, Cyberbot II, ChrisGualtieri, Vipinkumartvla, Khazar2, Vandit.P, Cpt.a.haddock, Soni, Kevinzhang27, Dexbot, Aborichan, FoCuSandLeArN, Intelligent 1000, Webclient101, Mogism, Anderson, Ajrawats, Nitesh.31jan, Svpnikhil, Sudhakaralakkaraju, Frosty, Utkarshsrathore, Pranakishore, ShobaRaghu, Neelkamala, Lionel maitre, Rajmaan, Aaceesh, Govindarajan Devarajan, Raulcaeser, Epicgenius, Rupeshkhandekar, BreakfastJr, Ameya barwe, Eshwar.om, Surfer43, Dkshields, Chasmanan, T.vicky, Truptilohar, Inventorfrog, Manjushree k, VishnuSR01, Vihangamarga, Babitaarora, Sandesh Saboo, Subasharavindan, Coolgama, Ugog Nizdast, Hansmuller, NotNott, Ginsuloft, Sam Sailor, Vibhanshudave, Arie.sudjono, Kkopalle, A3109366, Arjunkerishna90, Laxxuman, Winged Blades of Godric, Lakun.patra, Ethically Yours, Eshan101, Mkatz6693, Piyush badgajar, Monkbob, Calcium Cookie, Droigheann, India142, Sai santhosh00, Tigercompanion25, Varanasi51, Anuradha979, Payresh varman, Vaishakhshivaraman, Pradeepwb, T.Vamshi Krishna7, Ianjoy8311, Udon Nomaneim, Anumahn, Amortias, Ashvin213, Narky Blert, Johnnysaket, Mohanbhan, Krishna Kaasyap, Gagansc19, Yashthepunisher, Akshat729, DinoD123, IEditEncyclopedia, Mahajandeepakv, Devinleeele, Chsivanaga, Hemanththeman, Jamesjame, Ancient Hind, Capankajsmilyo, HackerX1, Rotiteybindi, CAPTAIN RAJU, Pvrmanoj, Dorpater, Amithm21, Svabhimani, HimynameisKuluUrumi, Crawford88, Pankaj kuwar, Biswabiscuit, Kaushal1684, Djauhari136, The Avengers, Amarnath.14, Khairulash, WP MANIKHANTA, Galaxy Kid, Krrish.Viky, GSS-1987, Agrawal.akshay98, Rajkumar 1 02, DarkyT, Anskd11798, Baddu676, BlueJaySings, Smbrooks, Bhaskarna, Rtrust, Gayatrisu, GreenC bot, Neha 0610, Tarasinghgheba, Jn045, Tophalguni, Artr trnr, Rugged Player, Vivitsa Kumar, Ind akash, ShizuokaCity, Emir of Wikipedia, JournalmanManila, Yashwanth6a, Bkahan1, Vinsmittal, Aanshi1106, Hindu443, Vincostantino, Priyarora, Francesvara, Mohanazadeh25, Strawberryangel2017, Nak.ngn, Prashant Raut, Vikrantsawant, Anil purohit, Psr106, AvalerionV, AtulR, Ayyappakancherla and Anonymous: 1235

- **Toyota Production System** *Source:* https://en.wikipedia.org/wiki/Toyota_Production_System?oldid=775083091 *Contributors:* The Anome, Michael Hardy, Paul A, Ronz, Kaihsu, Technopilgrim, Mydogategodshat, Gepwiki, Saltine, Yas-enwiki, Chris 73, Postdlf, Corneliier, Rhombus, Sunray, Jsan, DocWatson42, Crazysim, Ehusman, Comatose51, Beland, Kusunose, MementoVivere, Random contributor, Rich Farmbrough, Elwikipedista-enwiki, Spalding, R. S. Shaw, Maurreen, Share Bear, Mdd, BBird, Eleusis, Mandarax, Helvetius, Bcrounse, Benlisquare, YurikBot, Pip2andahalf, Chris Murphy, Dilaudid-enwiki, Alex43223, Wknight94, Intershark, Pil56, Juanscott, Nelson50, SmackBot, Facius, Quidam65, Tv316, The Rogue Penguin, Colonies Chris, Lhadnus, Curly Turkey, TurnerRupert, Hul12, Toddwill, Dan1679, Mrebus, Cydebot, Stebbins, Jayen466, Daniel J. Leivick, Cesare22, Qwyrxian, Leaders100, Edchi, WinBot, Widefox, Spencer, JAnDbot, Leanadvisors, Magioladitis, VoABot II, Vamaro, Sodabottle, Nposs, Hbent, E-pen, BeautifulFlying, Davandron, Bonadea, Jcay, Randomalious, Mathsux124, Sexymann48, Meiskam, Paulkrobertson, Indubitably, Wrobslie, Mcewan, Denknubbs-enwiki, Binatos666, Logan, UnneededAplomb, EJF, SieBot, Mramsey68, WereSpielChequers, Qst, Jocalozzo, MiNombreDeGuerra, Seth Whales, ClueBot, PipepBot, Nielspetermq, Waldoemerson, Lbertolotti, Abeywickrama, Jschrmidt163, Arvind1120, Mallowb, Dekisugi, Indra 94, ZooFari, Addbot, Dyson1, HATA A. K., SpBot, Culmensis, Franklin Dee, Tassedethe, Olly sunsky, Alex Rio Brazil, Opus 98543687, Polish Klang, Iuy789, Mps, Legobot, Baytazz, Yobot, Fraggie81, Yauhey, Rjanag, MaterialsScientist, HughesJohn, Citation bot, LilHelpa, PleaseJay, Capricorn42, Customlean, Omnipaedista, Richard BB, FrescoBot, Arlen22, Charlottepell, Ringovista, Crippled in 76, GR7689, Jonesey95, Saintonge235, Mike734, Krotz, GoodProd37, Lennon Arzam, Viable82, Ndsrichy, Craig.larman, EmausBot, Ajraddatz, Wilhkar, Erianna, L Kensington, Styko, ClueBot NG, Italo41, Joseph schreim, Avergara2010, Helpful Pixie Bot, BG19bot, Wilmjacob, Fteezy, JustBerry, Norix68k, SJ Defender, Stamptrader, JaconaFrere, Monkbob, U2fanboi, KasparBot, Shalom.o, Bender the Bot, Jblevisse and Anonymous: 175

43.12.2 Images

- **File:A_man_is_violently_rubbed_with_magnets._Coloured_lithograph_Welcome_V0011767.jpg** *Source:* https://upload.wikimedia.org/wikipedia/commons/b/b4/A_man_is_violently_rubbed_with_magnets._Coloured_lithograph_Welcome_V0011767.jpg *License:* CC BY 2.0 *Contributors:* <http://wellcomeimages.org/indexplus/image/V0011767.html> *Original artist:* ?
- **File:Aegopodium_podagraria1_ies.jpg** *Source:* https://upload.wikimedia.org/wikipedia/commons/b/bf/Aegopodium_podagraria1_ies.jpg *License:* CC-BY-SA-3.0 *Contributors:* Own work *Original artist:* Frank Vincentz
- **File:Aethina_tumida.jpg** *Source:* https://upload.wikimedia.org/wikipedia/commons/7/7e/Aethina_tumida.jpg *License:* CC-BY-SA-3.0 *Contributors:* Own work *Original artist:* Pollinator
- **File:Airport_overhead.jpg** *Source:* https://upload.wikimedia.org/wikipedia/commons/0/0f/Airport_overhead.jpg *License:* CC BY 2.0 *Contributors:* *Joining overhead Paraparaumu (Wellington, New Zealand)* by Phillip Capper via flickr: <http://www.flickr.com/photos/flissphil/8604604/> *Original artist:* Phillip Capper
- **File:Alliumvineale1web.jpg** *Source:* <https://upload.wikimedia.org/wikipedia/commons/d/da/Alliumvineale1web.jpg> *License:* Public domain *Contributors:* ? *Original artist:* ?

- **File:Ambox_globe_content.svg** Source: https://upload.wikimedia.org/wikipedia/commons/b/bd/Ambox_globe_content.svg License: Public domain Contributors: Own work, using File:Information icon3.svg and File:Earth clip art.svg Original artist: penubag
- **File:Ambox_important.svg** Source: https://upload.wikimedia.org/wikipedia/commons/b/b4/Ambox_important.svg License: Public domain Contributors: Own work, based off of Image:Ambox scales.svg Original artist: Dsmurat (talk · contribs)
- **File:Ambox_wikify.svg** Source: https://upload.wikimedia.org/wikipedia/commons/e/e1/Ambox_wikify.svg License: Public domain Contributors: Own work Original artist: penubag
- **File:An_Ramlila_Actor_In_The_Role_of_Ravana.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/1/16/An_Ramlila_Actor_In_The_Role_of_Ravana.jpg License: CC BY-SA 3.0 Contributors: Own work Original artist: Neeraj ChawlaNeerajhardik
- **File:Animated_cycle.gif** Source: https://upload.wikimedia.org/wikipedia/commons/1/1b/Animated_cycle.gif License: Public domain Contributors: Own work Original artist: António Miguel de Campos - en>User:Tó campos
- **File:Animation_of_the_growth_of_the_Mandelbrot_set_as_you_iterate_towards_infinity.gif** Source: https://upload.wikimedia.org/wikipedia/commons/f/f4/Animation_of_the_growth_of_the_Mandelbrot_set_as_you_iterate_towards_infinity.gif License: CC BY-SA 3.0 Contributors: Own work Original artist: Michael James Dean
- **File:Antiferromagnetic_ordering.svg** Source: https://upload.wikimedia.org/wikipedia/commons/5/5d/Antiferromagnetic_ordering.svg License: CC-BY-SA-3.0 Contributors: Drawing created myself Original artist: Michael Schmid
- **File:Aphomia_sociella_9626.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/e/e0/Aphomia_sociella_9626.jpg License: CC BY 2.5 Contributors: Own work Original artist: soebe
- **File:Ascospaera_apis_(Maasen_ex_Claussen)_L.S._Olive_&_Spiltoir_1324048.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/d/d9/Ascospaera_apis_%28Maasen_ex_Claussen%29_L.S._Olive_%26_Spiltoir_1324048.jpg License: CC BY 3.0 us Contributors: Ascospaera apis (Maasen ex Claussen) L.S. Olive & Spiltoir Original artist: Jeff Pettis from United States
- **File:Atomic_bombing_of_Japan.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/5/54/Atomic_bombing_of_Japan.jpg License: CC BY-SA 3.0 Contributors:
- **Nagasakibomb.jpg** Original artist: Nagasakibomb.jpg: The picture was taken by Charles Levy from one of the B-29 Superfortresses used in the attack.
- **File:Aum_Om_navy_blue_circle_hollow_coral.svg** Source: https://upload.wikimedia.org/wikipedia/commons/6/69/Aum_Om_navy_blue_circle_hollow_coral.svg License: Public domain Contributors: Own work Original artist: Ms Sarah Welch
- **File:Aum_Om_red.svg** Source: https://upload.wikimedia.org/wikipedia/commons/6/67/Aum_Om_red.svg License: Public domain Contributors: Own work Original artist: Ms Sarah Welch
- **File:Aum_Om_silver_circle_black.svg** Source: https://upload.wikimedia.org/wikipedia/commons/c/cd/Aum_Om_silver_circle_black.svg License: Public domain Contributors: Own work Original artist: Ms Sarah Welch
- **File:Avatars.jpg** Source: <https://upload.wikimedia.org/wikipedia/commons/a/a0/Avatars.jpg> License: Public domain Contributors: Painting from Jaipur, India; in the Victoria and Albert Museum, London. (site is redesigned, old description is also available in Britannica" Original artist: the Victoria and Albert Museum
- **File:Balinese_Ramayan-Sita_and_Hanuman.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/e/e5/Balinese_Ramayan-Sita_and_Hanuman.jpg License: CC BY 2.0 Contributors: Flickr Original artist: casey yancey
- **File:Battle_at_Lanka,_Ramayana,_Udaipur,_1649-53.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/a/a7/Battle_at_Lanka%2C_Ramayana%2C_Udaipur%2C_1649-53.jpg License: Public domain Contributors: British Library Original artist: Sahibdin
- **File:Bhirgaudi_Nepali.JPG** Source: https://upload.wikimedia.org/wikipedia/commons/c/c2/Bhirgaudi_Nepali.JPG License: CC BY-SA 3.0 Contributors: Own work Original artist: Krish Dulal
- **File:BlackVulture2.JPG** Source: <https://upload.wikimedia.org/wikipedia/commons/0/02/BlackVulture2.JPG> License: Public domain Contributors: ? Original artist: ?
- **File:Blacksmith_at_the_anvil_Welcome_L0005875.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/e/e0/Blacksmith_at_the_anvil_Welcome_L0005875.jpg License: CC BY 4.0 Contributors: http://welcomeimages.org/indexplus/obf_images/0d/03/01b0685e7dc3c793cbf85e7a4c79.jpg Original artist: ?
- **File:Blue_Mandelbrot_Zoom.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/f/fd/Blue_Mandelbrot_Zoom.jpg License: Public domain Contributors: Own work Original artist: Ishaan Gulrajani
- **File:Boeing_B-47B_rocket-assisted_take_off_on_April_15,_1954_061024-F-1234S-011.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/8/81/Boeing_B-47B_rocket-assisted_take_off_on_April_15%2C_1954_061024-F-1234S-011.jpg License: Public domain Contributors:

This Image was released by the United States Air Force with the ID 061024-F-1234S-011 (next).

This tag does not indicate the copyright status of the attached work. A normal copyright tag is still required. See Commons:Licensing for more information.

Original artist: US Air Force
- **File:Boeing_B-52D-70-BO_(SN_56-0582)_is_refueled_by_Boeing_KC-135A-BN_(SN_55-3127)_061127-F-1234S-009.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/e/e1/Boeing_B-52D-70-BO_%28SN_56-0582%29_is_refueled_by_Boeing_KC-135A-BN_%28SN_55-3127%29_061127-F-1234S-009.jpg License: Public domain Contributors: US. Government Original artist: ?
- **File:Books-aj.svg_aj_ashton_01.svg** Source: https://upload.wikimedia.org/wikipedia/commons/4/4b/Books-aj.svg_aj_ashton_01.svg License: CC0 Contributors: <https://openclipart.org/detail/105859/booksajsvg-aj-ashton-01> Original artist: AJ on openclipart.org
- **File:Breaegyps_clarki.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/8/87/Breaegyps_clarki.jpg License: CC BY 2.0 Contributors: Brea Condor fossil skeleton Original artist: Ellen from Ann Arbor, MI, USA

- **File:Buer.gif** Source: <https://upload.wikimedia.org/wikipedia/commons/d/d5/Buer.gif> License: Public domain Contributors: ? Original artist: ?
- **File:Building_a_Bridge_to_Sri_Lanka.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/c/c8/Building_a_Bridge_to_Sri_Lanka.jpg License: Public domain Contributors:
- <http://www.kamat.com/kalranga/mythology/ramayan/bridge.htm> Original artist:
- Illustration:- Balasaheb Pandit Pant Pratinidhi (author dead before 1952 (April 13, 1951) - see en:Bhawanrao Shrinivasrao Pant Pratinidhi
- **File:Burmese_Ramayana_dance.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/8/8c/Burmese_Ramayana_dance.jpg License: CC BY-SA 2.0 Contributors: Traditional Dance Original artist: Nguyen Thanh Long from Sai Gon, Viet Nam
- **File:Cape_cod_bay.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/b/b3/Cape_cod_bay.jpg License: Public domain Contributors: ? Original artist: ?
- **File:Cat_spay_scar.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/6/69/Cat_spay_scar.jpg License: CC BY 2.0 Contributors: mo scar Original artist: Bill Rhodes from Asheville
- **File:Cathartes_aura_-Santa_Teresa_County_Park,_San_Jose,_California,_USA_-adult-8a.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/7/78/Cathartes_aura_-Santa_Teresa_County_Park%2C_San_Jose%2C_California%2C_USA_-adult-8a.jpg License: CC BY 2.0 Contributors: Vulture Landing on Dead Tree Branch Original artist: Don DeBold from San Jose, CA, USA
- **File:Cathartes_burrovianus_JJK'1.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/b/b7/Cathartes_burrovianus_JJK%271.jpg License: CC BY-SA 3.0 Contributors: <http://www.jjkatura.com> Original artist: Jacek Kisielewski
- **File:Cholera_art.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/9/92/Cholera_art.jpg License: Public domain Contributors: A Short History of the National Institutes of Health National Library of Medicine photographic archive. Cholera "Tramples the victors & the vanquished both." Robert Seymour. U.S. National Library of Medicine Original artist: Robert Seymour
- **File:Circle_7_4.svg** Source: https://upload.wikimedia.org/wikipedia/commons/6/6a/Circle_7_4.svg License: CC BY-SA 3.0 Contributors: This diagram was created with gnuplot. Original artist: Adam majewski
- **File:Coat_of_arms_of_Norway.svg** Source: https://upload.wikimedia.org/wikipedia/commons/9/95/Coat_of_arms_of_Norway.svg License: Public domain Contributors: Own work Original artist: Damian Szczepaniak, Szczepan1990 (first upload); S. Solberg J., Ssolbergj (modification)
- **File:Coix_lacryma-jobi.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/7/73/Coix_lacryma-jobi.jpg License: CC BY-SA 4.0 Contributors: Own work Original artist: Craiggallan.za
- **File:Commons-logo.svg** Source: <https://upload.wikimedia.org/wikipedia/en/4/4a/Commons-logo.svg> License: PD Contributors: ? Original artist: ?
- **File:Coragyps-atratus-001.jpg** Source: <https://upload.wikimedia.org/wikipedia/commons/9/9d/Coragyps-atratus-001.jpg> License: CC-BY-SA-3.0 Contributors: first upload in en wikipedia on 21:55, 13 December 2005 by Mdf Original artist: Mdf
- **File:Coragyps-atratus-002.jpg** Source: <https://upload.wikimedia.org/wikipedia/commons/5/5c/Coragyps-atratus-002.jpg> License: CC-BY-SA-3.0 Contributors: ? Original artist: ?
- **File:Crystal_Clear_app_3d.png** Source: https://upload.wikimedia.org/wikipedia/commons/e/e4/Crystal_Clear_app_3d.png License: LGPL Contributors: All Crystal Clear icons were posted by the author as LGPL on kde-look; Original artist: Everaldo Coelho and YellowIcon;
- **File:DandelionFlower2.JPG** Source: <https://upload.wikimedia.org/wikipedia/commons/2/2e/DandelionFlower2.JPG> License: CC BY-SA 3.0 Contributors: Own work Original artist: UpstateNYer
- **File:Demm_2000_Mandelbrot_set.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/c/ca/Demm_2000_Mandelbrot_set.jpg License: Public domain Contributors: Own work Original artist: Adam majewski
- **File:Disrobing_of_Draupadi.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/5/5a/Disrobing_of_Draupadi.jpg License: Public domain Contributors: http://jameelcentre.ashmus.ox.ac.uk/collection/4/891/892/all/per_page/25/offset/50/sort_by/date/object/6958 Original artist: Nainsukh
- **File:Draupadi_and_Pandavas.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/e/e0/Draupadi_and_Pandavas.jpg License: Public domain Contributors: http://www.columbia.edu/itc/mealac/pritchett/00routesdata/bce_299_200/mahabharata/draupadiwife/draupadiwife.html Original artist: Raja Ravi Varma
- **File:EKV_prototype_launch.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/9/99/EKV_prototype_launch.jpg License: Public domain Contributors: <http://osd.dtic.mil/photos/Dec2001/011203-D-4867S-003.html> Original artist: U.S. Department of Defense
- **File>Edit-clear.svg** Source: <https://upload.wikimedia.org/wikipedia/en/f/f2/Edit-clear.svg> License: Public domain Contributors: The Tango! Desktop Project. Original artist: The people from the Tango! project. And according to the meta-data in the file, specifically: "Andreas Nilsson, and Jakub Steiner (although minimally)."
- **File:Electromagnet.gif** Source: <https://upload.wikimedia.org/wikipedia/commons/3/3c/Electromagnet.gif> License: CC BY-SA 3.0 Contributors: This file was created with Blender. Original artist: Anybody
- **File:Escape_Time_Algorithm_bands.png** Source: https://upload.wikimedia.org/wikipedia/commons/0/08/Escape_Time_Algorithm_bands.png License: Attribution Contributors: Own work by the original uploader Original artist: Michael Bradshaw
- **File:Ezekiel's_vision.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/c/c6/Ezekiel's_vision.jpg License: Public domain Contributors: http://www.biblical-art.com/artwork.asp?id_artwork=26660&showmode=Full From "L'Histoire du Vieux et du Nouveau Testament", Nicolas Fontaine (author). Call Number at Pitts Theology Library: 1670Font. Original artist: copy by unknown artist after illustration by Matthaeus (Matthäus) Merian the elder (1593-1650)
- **File:F-14D_LANTIRN.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/9/9b/F-14D_LANTIRN.jpg License: Public domain Contributors: ID:NSD0609188 / 050918N5088T001 Original artist: Service Depicted: Navy Camera Operator: LTJG SCOTT TIMMESTER, USN

- **File:F-15E_LANTIRN_IR_HUD_image.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/3/3a/F-15E_LANTIRN_IR_HUD_image.jpg License: Public domain Contributors: ID:DFST9103335 Original artist: Service Depicted: Air Force

Command Shown: F3335

Camera Operator: SENIOR AIRMAN BRAD FALLIN

- **File:F-15E_LANTIRN_pod.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/a/a9/F-15E_LANTIRN_pod.jpg License: Public domain Contributors: ID:DFST9103346 Original artist: Service Depicted: Air Force

Command Shown: F3335

Camera Operator: SENIOR AIRMAN JEFFREY S. WOLFE

- **File:Far_East_Chop_Suey_Little_Tokyo_LA.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/9/94/Far_East_Chop_Suey_Little_Tokyo_LA.jpg License: Public domain Contributors: Transferred from en.wikipedia to Commons by Benoit Rochon. Original artist: Everyguy at English Wikipedia
- **File:Fbi_duquesne.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/0/07/Fbi_duquesne.jpg License: Public domain Contributors: ? Original artist: ?
- **File:Female_dog_spay_incision.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/b/bd/Female_dog_spay_incision.jpg License: CC BY-SA 4.0 Contributors: Own work Original artist: Liannadavis
- **File:Ferrimagnetic_ordering.svg** Source: https://upload.wikimedia.org/wikipedia/commons/8/81/Ferrimagnetic_ordering.svg License: CC-BY-SA-3.0 Contributors: Drawing created myself Original artist: Michael Schmid
- **File:Ferromagneses_penzermek_1.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/f/f8/Ferromagneses_penzermek_1.jpg License: CC BY-SA 3.0 Contributors: Own work Original artist: Zátanyi Sándor, (ifj.) Fized
- **File:Flag-map_of_Jamaica.svg** Source: https://upload.wikimedia.org/wikipedia/commons/5/50/Flag-map_of_Jamaica.svg License: CC BY-SA 3.0 Contributors: Own work Original artist: Darwinek
- **File:Flag_of_India.svg** Source: https://upload.wikimedia.org/wikipedia/en/4/41/Flag_of_India.svg License: Public domain Contributors: ? Original artist: ?
- **File:Flag_of_Indonesia.svg** Source: https://upload.wikimedia.org/wikipedia/commons/9/9f/Flag_of_Indonesia.svg License: Public domain Contributors: Law: s.id:Undang-Undang Republik Indonesia Nomor 24 Tahun 2009 (http://badanbahasa.kemdiknas.go.id/lamanbahasa/sites/default/files/UU_2009_24.pdf) Original artist: Drawn by User:SKopp, rewritten by User:Gabbe
- **File:Flag_of_Iraq.svg** Source: https://upload.wikimedia.org/wikipedia/commons/f/f6/Flag_of_Iraq.svg License: Public domain Contributors:
 - This image is based on the CIA Factbook, and the website of Office of the President of Iraq, vectorized by User:Militaryace Original artist: Unknown, published by Iraqi government, vectorized by User:Militaryace based on the work of User:Hoshie
- **File:Flag_of_Italy.svg** Source: https://upload.wikimedia.org/wikipedia/en/0/03/Flag_of_Italy.svg License: PD Contributors: ? Original artist: ?
- **File:Flag_of_the_United_States.svg** Source: https://upload.wikimedia.org/wikipedia/en/a/a4/Flag_of_the_United_States.svg License: PD Contributors: ? Original artist: ?
- **File:Folder_Hexagonal_Icon.svg** Source: https://upload.wikimedia.org/wikipedia/en/4/48/Folder_Hexagonal_Icon.svg License: Cc-by-sa-3.0 Contributors: ? Original artist: ?
- **File:Food_production_per_capita.svg** Source: https://upload.wikimedia.org/wikipedia/commons/8/8f/Food_production_per_capita.svg License: CC BY-SA 4.0 Contributors: Own work Original artist: Grendelkhan
- **File:Foodlogo2.svg** Source: <https://upload.wikimedia.org/wikipedia/commons/d/d6/Foodlogo2.svg> License: CC-BY-SA-3.0 Contributors: Original Original artist: Seahen
- **File:Four_Sons_of_Dasaratha.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/1/14/Four_Sons_of_Dasaratha.jpg License: Public domain Contributors: <http://www.bl.uk/learning/cult/inside/gallery/4sons/foursons.html> Original artist: Unknown
- **File:Fractal-zoom-1-03-Mandelbrot_Buzzsaw.png** Source: https://upload.wikimedia.org/wikipedia/commons/a/aa/Fractal-zoom-1-03-Mandelbrot_Buzzsaw.png License: Public domain Contributors: ? Original artist: ?
- **File:Fractal_fern_explained.png** Source: https://upload.wikimedia.org/wikipedia/commons/4/4b/Fractal_fern_explained.png License: Public domain Contributors: Own work Original artist: António Miguel de Campos
- **File:FullPagadeYakshagana.jpg** Source: <https://upload.wikimedia.org/wikipedia/commons/e/ef/FullPagadeYakshagana.jpg> License: CC-BY-SA-3.0 Contributors: ? Original artist: ?
- **File:Ganesa_writing_the_Mahabharat.jpeg** Source: https://upload.wikimedia.org/wikipedia/commons/9/95/Ganesa_writing_the_Mahabharat.jpeg License: Public domain Contributors: <http://www.mfa.org/collections/object/ganesa-writing-the-mahabharat-dictated-by-vyasa-149627> Original artist: Indian, Rajasthani,
- **File:Gimp-fractal-explorer.png** Source: <https://upload.wikimedia.org/wikipedia/commons/a/ab/Gimp-fractal-explorer.png> License: CC BY-SA 3.0 Contributors: Own work Original artist: DingedBat

- **File:Goblet_Glass_(Banquet).svg** Source: https://upload.wikimedia.org/wikipedia/commons/e/e2/Goblet_Glass_%28Banquet%29.svg License: CC0 Contributors: Own work Original artist: This image is an original work by "Will Murray (Willsrlt)". Attribution is requested, but not required. It should include the author's name, his username in parentheses as shown, and a link to either his Website at <http://willmurray.name> or his online gallery at <http://willmurraymedia.com>. The author also appreciates notification if you use his work outside Wikimedia.
- **File:Greater_Yellow-headed_Vulture_(Cathartes_melambrotus)_in_flight_from_below.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/5/59/Greater_Yellow-headed_Vulture_%28Cathartes_melambrotus%29_in_flight_from_below.jpg License: CC BY 2.0 Contributors: Cathartes melambrotus Original artist: Sidnei Dantas
- **File:Guha_King_of_the_hunter_tribe_(Nishadas)_helped_the_rama_and_his_companions_to_cross_the_river.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/d/d8/Guha%2C_King_of_the_hunter_tribe_%28Nishadas%29_helped_the_rama_and_his_companions_to_cross_the_river.jpg License: Public domain Contributors: <https://tamilandvedas.com/tag/ayodhya-kanda-pictures/> Original artist: by Ramachandra Madhwa Mahishi, Illustrated by Balasaheb Pandit Pant Pratinidhi
- **File:Gymnogyps_californianus_-_San_Diego_Zoo-8a.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/d/d5/Gymnogyps_californianus_-_San_Diego_Zoo-8a.jpg License: CC BY 2.0 Contributors: california condor Original artist: Stacy from San Diego
- **File:Hanuman_before_Rama.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/0/0b/Hanuman_before_Rama.jpg License: Public domain Contributors: ? Original artist: ?
- **File:Heinkel_He_111_during_the_Battle_of_Britain.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/8/82/Heinkel_He_111_during_the_Battle_of_Britain.jpg License: Public domain Contributors: This is photograph MH6547 from the collections of the Imperial War Museums (collection no. 4700-05) Original artist: Unknown
- **File:Hermitage_of_Valmiki_Folio_from_the__xunadd_text_character:nN{\textquotedbl}{''}}Nadaun_xunadd_text_character:nN{\textquotedbl}{''}}_Ramayana_(Adventures_of_Rama)_LACMA_AC1999.127.45.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/e/ea/Hermitage_of_Valmiki%2C_Folio_from_the_%22Nadaun%22_Ramayana_%28Adventures_of_Rama%29_LACMA_AC1999.127.45.jpg License: Public domain Contributors:
- Image: http://collections.lacma.org/sites/default/files/remote_images/piction/ma-31209102-O3.jpg Original artist: ?
- **File:HinduSwastika.svg** Source: <https://upload.wikimedia.org/wikipedia/commons/6/63/HinduSwastika.svg> License: Public domain Contributors: ? Original artist: ?
- **File:Hiroshima_aftermath.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/a/a0/Hiroshima_aftermath.jpg License: Public domain Contributors:
- <http://www.chinfo.navy.mil/navpalib/images/historical/hiroshima.jpg> Original artist: U.S. Navy Public Affairs Resources Website
- **File:Hot_and_Spicy_Leftovers.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/8/85/Hot_and_Spicy_Leftovers.jpg License: CC BY-SA 2.0 Contributors: Auntie Shirley's Hot and Spicy Leftovers 菜尾 Original artist: Alpha from Melbourne, Australia
- **File:INSTRUVCTIA_NAVKA_JAK_SIE_SPRAWOWAĆ_CZASV_MORV.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/6/6d/INSTRUVCTIA_NAVKA_JAK_SIE_SPRAWOWAĆ_CZASV_MORV.jpg License: Public domain Contributors: Sebastian Petrycy "Instructia abo nauka, jak się sprawować czasu moru, Kraków 1613 Original artist: Sebastian Petrycy (1554-1626)
- **File:Johnny-automatic-scales-of-justice.svg** Source: <https://upload.wikimedia.org/wikipedia/commons/9/9a/Johnny-automatic-scales-of-justice.svg> License: CC0 Contributors: <https://openclipart.org/detail/26849/scales-of-justice> Original artist: johnny_automatic
- **File:JohnvonNeumann-LosAlamos.gif** Source: <https://upload.wikimedia.org/wikipedia/commons/5/5e/JohnvonNeumann-LosAlamos.gif> License: Public domain Contributors: <http://www.lanl.gov/history/atomicbomb/images/NeumannL.GIF> (Archive copy at the Wayback Machine (archived on 11 March 2010)) Original artist: LANL
- **File:Juliacycles1.png** Source: <https://upload.wikimedia.org/wikipedia/commons/2/2f/Juliacycles1.png> License: Public domain Contributors: Own work Original artist: António Miguel de Campos - en>User:Tó campos
- **File:KITLV_28308_-_Isidore_van_Kinsbergen_-_Relief_with_part_of_the_Ramayana_epic_in_front_of_Panataran_Kediri_-_1867-02-1867-06.tif** Source: https://upload.wikimedia.org/wikipedia/commons/8/85/KITLV_28308_-_Isidore_van_Kinsbergen_-_Relief_with_part_of_the_Ramayana_epic_in_front_of_Panataran%2C_Kediri_-_1867-02-1867-06.tif License: Public domain Contributors: Leiden University Library, KITLV, image 28308 Homepage media-kitlv.nl KITLV Original artist: Isidore van Kinsbergen
- **File:Karwar_Pictures_-_Yogesa_19.JPG** Source: https://upload.wikimedia.org/wikipedia/commons/2/22/Karwar_Pictures_-_Yogesa_19.JPG License: CC BY-SA 3.0 Contributors: Own work Original artist: Yogesa
- **File:Khon_Dance_Frankfurt_Germany_2006.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/0/0b/Khon_Dance_Frankfurt_Germany_2006.jpg License: Public domain Contributors: Own work Original artist: Günter Trageser
- **File:Krishna_and_Arjun_on_the_chariot_Mahabharata_18th-19th_century_India.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/3/37/Krishna_and_Arjun_on_the_chariot%2C_Mahabharata%2C_18th-19th_century%2C_India.jpg License: Public domain Contributors: Simthsonian Freer Sackler Gallery [1] Original artist: Anonymous
- **File:Kurukshetra.jpg** Source: <https://upload.wikimedia.org/wikipedia/commons/8/81/Kurukshetra.jpg> License: Public domain Contributors: ? Original artist: ?
- **File:LANTIRN_artist_concept.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/9/90/LANTIRN_artist_concept.jpg License: Public domain Contributors: ID:DFST8406289 Original artist: Service Depicted: Air Force Camera Operator: TSGT BELCHER/G. F. JONES
- **File:Lavaurs-12.png** Source: <https://upload.wikimedia.org/wikipedia/commons/4/43/Lavaurs-12.png> License: CC BY-SA 3.0 Contributors: own code based on the Lisp code by R Berenguel Original artist: Adam majewski
- **File:Leftovers-food.jpg** Source: <https://upload.wikimedia.org/wikipedia/commons/4/43/Leftovers-food.jpg> License: CC BY-SA 3.0 Contributors: Own work Original artist: Gates of Ale

- **File:Leftovers_(5211806675).jpg** Source: https://upload.wikimedia.org/wikipedia/commons/3/32/Leftovers_%285211806675%29.jpg License: CC BY-SA 2.0 Contributors: Leftovers Original artist: Lisa Risager
- **File:Leftovers_from_Thanksgiving.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/0/0b/Leftovers_from_Thanksgiving.jpg License: CC BY-SA 2.0 Contributors: Leftover Turkey Dec09 - 9 Original artist: Andrew Nash from Vienna, Austria
- **File:Let_debate_begin_-_geograph.org.uk_-_778991.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/3/31/Let_debate_begin_-_geograph.org.uk_-_778991.jpg License: CC BY-SA 2.0 Contributors: From geograph.org.uk Original artist: Pauline Eccles
- **File:Lock-green.svg** Source: <https://upload.wikimedia.org/wikipedia/commons/6/65/Lock-green.svg> License: CC0 Contributors: en:File:Free-to-read_lock_75.svg Original artist: User:Trappist the monk
- **File:Lodestone_attracting_nails.png** Source: https://upload.wikimedia.org/wikipedia/commons/2/20/Lodestone_attracting_nails.png License: Public domain Contributors: Downloaded 2008-11-04 from <a data-x-rel='nofollow' class='external text' href='http://books.google.com/books?id=x_8JAAAAIAAJ,,&,pg=PA11'>Fred Anzley Annet (1921) *Electrical Machinery: A practical study course on installation, operation, and maintenance, 1st Ed.*, McGraw-Hill, New York, p.11, fig.3 on Google Books Original artist: Fred Anzley Annet
- **File:Logo_sociology.svg** Source: https://upload.wikimedia.org/wikipedia/commons/a/a6/Logo_sociology.svg License: Public domain Contributors: Own work Original artist: Tomeq183
- **File:MND31.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/b/b8/Lakshamana_cuts_Surpanaka%27s_nose.jpg License: GFDL Contributors: <http://ceaa.colmex.mx/profesores/benjaminpreciado/imagenespaginapreciado/MND31.jpeg> Original artist: Fotografía tomada por el Dr. Benjamín Preciado Centro de Estudios de Asia y África de El Colegio de México
- **File:MPDAbandonedCarSticker.JPG** Source: <https://upload.wikimedia.org/wikipedia/en/2/22/MPDAbandonedCarSticker.JPG> License: PD Contributors: self-made Original artist: 293.xx.xxx.xx (talk)
- **File:Macso.jpg** Source: <https://upload.wikimedia.org/wikipedia/commons/5/5c/Macso.jpg> License: Public domain Contributors: This media is available in the holdings of the National Archives and Records Administration, cataloged under the National Archives Identifier (NAID) missing. Original artist: ?
- **File:Magnet0873.png** Source: <https://upload.wikimedia.org/wikipedia/commons/5/57/Magnet0873.png> License: Public domain Contributors: <a data-x-rel='nofollow' class='external text' href='http://books.google.com/books?id=BT8AAAAAYAAJ,,&,pg=PA242'>Newton Henry Black, Harvey N. Davis (1913) *Practical Physics*, The MacMillan Co., USA, p. 242, fig. 200 Original artist: Newton Henry Black
- **File:Magnetic_Domains_2.svg** Source: https://upload.wikimedia.org/wikipedia/commons/4/44/Magnetic_Domains_2.svg License: CC BY-SA 3.0 Contributors: Own work Original artist: Denis Fadeev
- **File:Magnetic_Domains_3.svg** Source: https://upload.wikimedia.org/wikipedia/commons/e/e0/Magnetic_Domains_3.svg License: CC BY-SA 3.0 Contributors: Own work Original artist: Denis Fadeev
- **File:Magnetic_quadrupole_moment.svg** Source: https://upload.wikimedia.org/wikipedia/commons/9/93/Magnetic_quadrupole_moment.svg License: Public domain Contributors: Originally uploaded to the English Language Wikipedia Original artist: K. Aainsqatsi at English Wikipedia
- **File:Magnetism.svg** Source: <https://upload.wikimedia.org/wikipedia/commons/a/aa/Magnetism.svg> License: Public domain Contributors: Own work Original artist: John Apledred
- **File:MagnetismFromLengthContraction.png** Source: <https://upload.wikimedia.org/wikipedia/commons/0/01/MagnetismFromLengthContraction.png> License: CC BY-SA 3.0 Contributors: Own work Original artist: P. Fraundorf
- **File:Malthus_PL_en.svg** Source: https://upload.wikimedia.org/wikipedia/commons/d/d9/Malthus_PL_en.svg License: CC BY-SA 3.0 Contributors: translated from Malthus_PL.svg Original artist: Malthus_PL.svg: Kravietz
- **File:Mandel.png** Source: <https://upload.wikimedia.org/wikipedia/commons/d/d7/Mandel.png> License: Public domain Contributors: Own work Original artist: Elphaba
- **File:Mandel_rays.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/6/6a/Mandel_rays.jpg License: Public domain Contributors: Own work Original artist: António Miguel de Campos - en:User:Tó campos
- **File:Mandel_zoom_00_mandelbrot_set.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/2/21/Mandel_zoom_00_mandelbrot_set.jpg License: CC-BY-SA-3.0 Contributors: ? Original artist: ?
- **File:Mandel_zoom_01_head_and_should.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/e/ee/Mandel_zoom_01_head_and_should.jpg License: CC-BY-SA-3.0 Contributors: ? Original artist: ?
- **File:Mandel_zoom_02_seehorse_valley.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/5/58/Mandel_zoom_02_seehorse_valley.jpg License: CC-BY-SA-3.0 Contributors: ? Original artist: ?
- **File:Mandel_zoom_03_seehorse.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/5/5b/Mandel_zoom_03_seehorse.jpg License: CC-BY-SA-3.0 Contributors: ? Original artist: ?
- **File:Mandel_zoom_04_seehorse_tail.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/b/b5/Mandel_zoom_04_seehorse_tail.jpg License: CC-BY-SA-3.0 Contributors: ? Original artist: ?
- **File:Mandel_zoom_05_tail_part.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/8/82/Mandel_zoom_05_tail_part.jpg License: CC-BY-SA-3.0 Contributors: ? Original artist: ?
- **File:Mandel_zoom_06_double_hook.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/f/f3/Mandel_zoom_06_double_hook.jpg License: CC-BY-SA-3.0 Contributors: ? Original artist: ?
- **File:Mandel_zoom_07_satellite.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/b/b3/Mandel_zoom_07_satellite.jpg License: CC-BY-SA-3.0 Contributors: ? Original artist: ?

- **File:Mandel_zoom_08_satellite_antenna.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/f/fc/Mandel_zoom_08_satellite_antenna.jpg License: CC-BY-SA-3.0 Contributors: ? Original artist: ?
- **File:Mandel_zoom_09_satellite_head_and_shoulder.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/2/2f/Mandel_zoom_09_satellite_head_and_shoulder.jpg License: CC-BY-SA-3.0 Contributors: ? Original artist: ?
- **File:Mandel_zoom_10_satellite_seehorse_valley.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/8/89/Mandel_zoom_10_satellite_seehorse_valley.jpg License: CC-BY-SA-3.0 Contributors: ? Original artist: ?
- **File:Mandel_zoom_11_satellite_double_spiral.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/a/a4/Mandel_zoom_11_satellite_double_spiral.jpg License: CC-BY-SA-3.0 Contributors: Created by Wolfgang Beyer with the program *Ultra Fractal 3*. Original artist: Wolfgang Beyer
- **File:Mandel_zoom_12_satellite_spirally_wheel_with_julia_islands.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/5/5c/Mandel_zoom_12_satellite_spirally_wheel_with_julia_islands.jpg License: CC-BY-SA-3.0 Contributors: ? Original artist: ?
- **File:Mandel_zoom_13_satellite_seehorse_tail_with_julia_island.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/f/fb/Mandel_zoom_13_satellite_seehorse_tail_with_julia_island.jpg License: CC-BY-SA-3.0 Contributors: ? Original artist: ?
- **File:Mandel_zoom_14_satellite_julia_island.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/3/37/Mandel_zoom_14_satellite_julia_island.jpg License: CC-BY-SA-3.0 Contributors: ? Original artist: ?
- **File:Mandel_zoom_15_one_island.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/5/52/Mandel_zoom_15_one_island.jpg License: Public domain Contributors: ? Original artist: ?
- **File:Mandel_zoom_16_spiral_island.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/e/eb/Mandel_zoom_16_spiral_island.jpg License: Public domain Contributors: [2] Original artist: [3]
- **File:MandelbrotOrbitInfimum.png** Source: <https://upload.wikimedia.org/wikipedia/commons/c/c9/MandelbrotOrbitInfimum.png> License: Public domain Contributors: Own work Original artist: Paintthread
- **File:Mandelbrot_DEM_Sobel.png** Source: https://upload.wikimedia.org/wikipedia/commons/1/14/Mandelbrot_DEM_Sobel.png License: CC BY-SA 3.0 Contributors: my own work with use of code by Wolf Jung (www.mndynamics.com) and by J. C. Sprott* [#cite_note-1 [1]] Original artist: Adam majewski
- **File:Mandelbrot_Interior_600.png** Source: https://upload.wikimedia.org/wikipedia/commons/3/34/Mandelbrot_Interior_600.png License: Public domain Contributors: Uploaded to the English language Wikipedia in December 2007 (log) Original artist: Milan va (talk)
- **File:Mandelbrot_Set_Animation_1280x720.gif** Source: https://upload.wikimedia.org/wikipedia/commons/7/72/Mandelbrot_Set_Animation_1280x720.gif License: CC BY-SA 4.0 Contributors: Own work Original artist: Helibene
- **File:Mandelbrot_Set_-_Periodicities_coloured.png** Source: https://upload.wikimedia.org/wikipedia/commons/0/0e/Mandelbrot_Set_%E2%80%93_Periodicities_coloured.png License: CC-BY-SA-3.0 Contributors: No machine-readable source provided. Own work assumed (based on copyright claims). Original artist: No machine-readable author provided. Hoehue~commonswiki assumed (based on copyright claims).
- **File:Mandelbrot_sequence_new_still.png** Source: https://upload.wikimedia.org/wikipedia/commons/7/7f/Mandelbrot_sequence_new_still.png License: Public domain Contributors: File:Mandelbrot_sequence_new.gif Original artist: ?
- **File:Mandelbrot_set_image.png** Source: https://upload.wikimedia.org/wikipedia/commons/a/a7/Mandelbrot_set_image.png License: CC BY-SA 3.0 Contributors: Own work Original artist: Binette228
- **File:Mandelbrot_zoom.gif** Source: https://upload.wikimedia.org/wikipedia/commons/c/ce/Mandelbrot_zoom.gif License: Public domain Contributors: Original uploaded on en.wikipedia Original artist: Original uploaded by Cuddlyable3 (Transferred by TeleComNasSprVen)
- **File:Mandelset_hires.png** Source: https://upload.wikimedia.org/wikipedia/commons/5/56/Mandelset_hires.png License: Public domain Contributors: ? Original artist: Connelly (talk · contribs)
- **File:Mandelzoom1.jpg** Source: <https://upload.wikimedia.org/wikipedia/commons/f/f4/Mandelzoom1.jpg> License: Public domain Contributors: JAVA animation Original artist: António Miguel de Campos
- **File:Map_of_Vietnam_showing_Prairie_Fire_Area_(as_per_Military_Assistance_Command,_Vietnam_-_Studies_and_Observations_Group).jpg** Source: https://upload.wikimedia.org/wikipedia/en/b/b5/Map_of_Vietnam_showing_Prairie_Fire_Area_%28as_per_Military_Assistance_Command%2C_Vietnam_%E2%80%93_Studies_and_Observations_Group%29.jpg License: PD Contributors: ? Original artist: ?
- **File:Martyrdom_of_Joseph_Marchand.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/a/a8/Martyrdom_of_Joseph_Marchand.jpg License: CC BY-SA 3.0 Contributors: Own work by uploader, personal photograph of 1860 painting at the MEP Original artist: PHGCOM
- **File:Martyrerp_2.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/f/f9/Martyrerp_2.jpg License: Public domain Contributors: Le Monde illustré, 27 février 1858, Original artist: Unknown
- **File:MayflowerHarbor.jpg** Source: <https://upload.wikimedia.org/wikipedia/commons/0/08/MayflowerHarbor.jpg> License: Public domain Contributors: <http://www.artcom.com/Museums/vs/mr/02360-38.htm> Original artist: William Halsall
- **File:Mayflower_Society_Museum.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/f/f9/Mayflower_Society_Museum.jpg License: CC BY-SA 3.0 Contributors: Transferred from en.wikipedia Original artist: Swampyank at en.wikipedia
- **File:Mint_lemonade.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/9/94/Mint_lemonade.jpg License: CC BY-SA 3.0 Contributors: Own work Original artist: Bernard Gagnon
- **File:Mirepoix_on_cutting_board.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/4/44/Mirepoix_on_cutting_board.jpg License: CC BY-SA 3.0 Contributors: I made the mirepoix at home and took a picture of it on my cell phone. Original artist: Pigup

- **File:Moroccan_soldiers_at_Monte_Cassino.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/3/33/Moroccan_soldiers_at_Monte_Cassino.jpg License: Public domain Contributors: L'Italia settimanale, N°7 anno III 23 febbraio 1994, pag.46 Original artist: anonymous photograph
- **File:National_Coat_of_arms_of_Denmark_no_crown.svg** Source: https://upload.wikimedia.org/wikipedia/commons/d/d1/National_Coat_of_arms_of_Denmark_no_crown.svg License: CC BY-SA 3.0 Contributors: File:National_Coat_of_arms_of_Denmark.svg Original artist: User:Galico; User:Derfel73
- **File:Neminath_Wedding.JPG** Source: https://upload.wikimedia.org/wikipedia/commons/0/01/Neminath_Wedding.JPG License: Public domain Contributors: Own work Original artist: Anishshah19
- **File:Nimby_unfinished_tower_(cropped).jpg** Source: https://upload.wikimedia.org/wikipedia/commons/2/24/Nimby_unfinished_tower_%28cropped%29.jpg License: CC BY 2.0 Contributors: NIMBY? Original artist: Kate Mereand from Washington, DC, United States
- **File:Normalized_Iteration_Count_Algorithm_1.png** Source: https://upload.wikimedia.org/wikipedia/commons/c/c0/Normalized_Iteration_Count_Algorithm_1.png License: Attribution Contributors: Own work by the original uploader Original artist: Michael Bradshaw
- **File:North_Vietnamese_P-4_under_fire_from_USS_Maddox_(2_August_1964).jpg** Source: https://upload.wikimedia.org/wikipedia/commons/5/5c/North_Vietnamese_P-4_under_fire_from_USS_Maddox_%282_August_1964%29.jpg License: Public domain Contributors: Official U.S. Navy photo USN 711524 from the U.S. Navy Naval History and Heritage Command Original artist: U.S. Navy
- **File:OODA.Boyd.svg** Source: <https://upload.wikimedia.org/wikipedia/commons/3/3a/OODA.Boyd.svg> License: CC BY 3.0 Contributors: Own work Original artist: Patrick Edwin Moran
- **File:Open_Access_logo_PLoS_transparent.svg** Source: https://upload.wikimedia.org/wikipedia/commons/7/77/Open_Access_logo_PLoS_transparent.svg License: CC0 Contributors: <http://www.plos.org/> Original artist: art designer at PLoS, modified by Wikipedia users Nina, Beao, and JakobVoss
- **File:P_literature.svg** Source: https://upload.wikimedia.org/wikipedia/commons/1/1d/P_literature.svg License: CC-BY-SA-3.0 Contributors: No machine-readable source provided. Own work assumed (based on copyright claims). Original artist: No machine-readable author provided. Chris-martin assumed (based on copyright claims).
- **File:P_vip.svg** Source: https://upload.wikimedia.org/wikipedia/en/6/69/P_vip.svg License: PD Contributors: ? Original artist: ?
- **File:Painted_Grey_Ware_Culture_(1200-600_BCE).png** Source: https://upload.wikimedia.org/wikipedia/commons/8/8c/Painted_Grey_Ware_Culture_%281200-600_BCE%29.png License: CC BY-SA 3.0 Contributors: Own work Original artist: Avantiputra7
- **File:Peacekeeper_RV_vehicles.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/9/9a/Peacekeeper_RV_vehicles.jpg License: Public domain Contributors: US Air Force Original artist: US Air Force
- **File:People_icon.svg** Source: https://upload.wikimedia.org/wikipedia/commons/3/37/People_icon.svg License: CC0 Contributors: Open-Clipart Original artist: OpenClipart
- **File:Planetary_boundaries.svg** Source: https://upload.wikimedia.org/wikipedia/commons/7/70/Planetary_boundaries.svg License: CC BY-SA 3.0 Contributors: Own work Original artist: Christian Leichenring
- **File:Portal-puzzle.svg** Source: <https://upload.wikimedia.org/wikipedia/en/f/fd/Portal-puzzle.svg> License: Public domain Contributors: ? Original artist: ?
- **File:Queen_Ann's_Lace_(Daucus_carota).jpg** Source: https://upload.wikimedia.org/wikipedia/commons/c/c9/Queen_Ann's_Lace_%28Daucus_carota%29.jpg License: Public domain Contributors: Transferred from en.wikipedia to Commons. Original artist: KariMelissa75 at English Wikipedia
- **File:Question_book-new.svg** Source: https://upload.wikimedia.org/wikipedia/en/9/99/Question_book-new.svg License: Cc-by-sa-3.0 Contributors: Created from scratch in Adobe Illustrator. Based on Image:Question book.png created by User:Equazcion Original artist: Tkgd2007
- **File:Quill_and_ink.svg** Source: https://upload.wikimedia.org/wikipedia/commons/c/c4/Quill_and_ink.svg License: CC BY-SA 2.5 Contributors: Own work Original artist: Ebrenc at Catalan Wikipedia
- **File:Rafi_card.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/3/35/Rafi_card.jpg License: Public domain Contributors: Transferred from ru.wikipedia Original artist: . Original uploader was Талех at ru.wikipedia
- **File:Rama_and_monkey_chiefs.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/d/da/Rama_and_monkey_chiefs.jpg License: Public domain Contributors: http://www.britishmuseum.org/research/search_the_collection_database/search_object_image.aspx?objectId=182857&partId=1&searchText=rama&fromADBC=ad&toADBC=ad&orig=%2fresearch%2fsearch_the_collection_database.aspx&images=on&numPages=10¤tPage=3&asset_id=283217 Original artist: Unknown
- **File:Ramapanchayan,_Raja_Ravi_Varma_(Lithograph).jpg** Source: https://upload.wikimedia.org/wikipedia/commons/d/d1/Ramapanchayan%2C_Raja_Ravi_Varma_%28Lithograph%29.jpg License: Public domain Contributors: http://www.columbia.edu/itc/mealc/pritchett/00routesdata/bce_299_200/ramayana/enthronement/enthronement.html Original artist: Raja Ravi Varma
- **File:Ramayana_Java.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/6/60/Ramayana_Java.jpg License: CC BY-SA 3.0 Contributors: Own work Original artist: Gunawan Kartapranata
- **File:Rashid_Taan_card2003.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/b/bc/Rashid_Taan_card2003.jpg License: Public domain Contributors: Transferred from ru.wikipedia Original artist: Центральное командование ЧША. Original uploader was Талех at ru.wikipedia
- **File:Ravi_Varma-Rama-breaking-bow.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/8/84/Ravi_Varma-Rama-breaking-bow.jpg License: Public domain Contributors: Original source not stated by uploader, however copies available over internet including this. Original artist: Raja Ravi Varma

- **File:Ravi_Varma-Ravana_Sita_Jathayu.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/a/ac/Ravi_Varma-Ravana_Sita_Jathayu.jpg License: Public domain Contributors: Not stated by uploader Original artist: Raja Ravi Varma
- **File:Ravi_Varma-Shantanu_and_Satyavati.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/f/f6/Ravi_Varma-Shantanu_and_Satyavati.jpg License: Public domain Contributors: <http://www.cyberkerala.com/rajaravivarma/rvrtm38.htm> Original artist: Raja Ravi Varma
- **File:Razmnama_Bhishma.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/c/c1/Razmnama_Bhishma.jpg License: Public domain Contributors:
- <http://www.harekrsna.com/sun/features/12-09/features1568.htm> Original artist: Akbar
- **File:Red_Pencil_Icon.png** Source: https://upload.wikimedia.org/wikipedia/commons/7/74/Red_Pencil_Icon.png License: CC0 Contributors: Own work Original artist: Peter coxhead
- **File:Redwing_Apache.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/a/a6/Redwing_Apache.jpg License: Public domain Contributors: This image is available from the National Nuclear Security Administration Nevada Site Office Photo Library under number XX-35. Original artist: Federal Government of the United States
- **File:Relationship_between_Mandelbrot_sets_and_Julia_sets.PNG** Source: https://upload.wikimedia.org/wikipedia/commons/1/19/Relationship_between_Mandelbrot_sets_and_Julia_sets.PNG License: Public domain Contributors: I (Simpsons contributor (talk)) created this work entirely by myself. (Transferred from en.wikipedia to Commons by TeleComNasSprVen.) Original artist: Simpsons contributor (talk)
- **File:Robert_McNamara_official_portrait.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/2/2b/Robert_McNamara_official_portrait.jpg License: Public domain Contributors: <http://www.defense.gov/photos/newsphoto.aspx?newsphotoid=11425> (http://www.defense.gov/dodcmssshare/newsphoto/2009-07/hires_PCC-53242.jpg direct link) Original artist: DoD photo by Oscar Porter, U.S. Army.
- **File:SAS_2010_F-15E_LANTIRN.JPG** Source: https://upload.wikimedia.org/wikipedia/commons/a/aa/SAS_2010_F-15E_LANTIRN.JPG License: CC BY-SA 3.0 Contributors: Own work Original artist: Dave1185
- **File:SOG_hidden.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/d/d3/SOG_hidden.jpg License: Public domain Contributors: From the book : Joel D. Meyerson, *Images of a Lengthy War*. Washington DC: US Army Center of Military History, 1986 (p. 206) Original artist: SOG
- **File:STEMMA_DEL_MACVSOG.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/0/0b/STEMMA_DEL_MACVSOG.jpg License: Public domain Contributors: <http://aircommandoman.tripod.com/sitebuildercontent/sitebuilderpictures/sogpat-{ }1.jpg> Original artist: Un soldato del MACVSOG
- **File:Sarcoramphus_papa_-National_Zoo_-Washington_-USA-8a.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/d/d6/Sarcoramphus_papa_-National_Zoo_-Washington_-USA-8a.jpg License: CC BY-SA 2.0 Contributors: originally posted to Flickr as King Vulture Original artist: Eric Kilby
- **File:Schnittlauch_und_Zwiebeln_(23199864535).jpg** Source: https://upload.wikimedia.org/wikipedia/commons/7/75/Schnittlauch_und_Zwiebeln_%2823199864535%29.jpg License: CC BY 2.0 Contributors: Schnittlauch und Zwiebeln Original artist: Marco Verch
- **File:Seal_of_the_US_Air_Force.svg** Source: https://upload.wikimedia.org/wikipedia/commons/2/23/Seal_of_the_US_Air_Force.svg License: Public domain Contributors: SVG created from this image Original artist: Arthur E. DuBois, according to [1]
- **File:Searchtool.svg** Source: <https://upload.wikimedia.org/wikipedia/en/6/61/Searchtool.svg> License: ? Contributors: ? Original artist: ?
- **File:Sha.jpg** Source: <https://upload.wikimedia.org/wikipedia/en/a/a6/Sha.jpg> License: PD Contributors: ? Original artist: ?
- **File:Sita_at_ashokavana.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/2/24/Sita_at_ashokavana.jpg License: Public domain Contributors: [1] Original artist: Unknown
- **File:Snakesacrifice.jpg** Source: <https://upload.wikimedia.org/wikipedia/commons/c/c8/Snakesacrifice.jpg> License: Public domain Contributors: http://www.columbia.edu/itc/mealac/pritchett/00routesdata/bce_299_200/mahabharata/ganeshwrits/ganeshwrits.html Original artist: Unknown
- **File:Southampton-MayflowerMemorial.jpg** Source: <https://upload.wikimedia.org/wikipedia/commons/d/d6/Southampton-MayflowerMemorial.jpg> License: Public domain Contributors: Transferred from en.wikipedia to Commons by Naudefj using CommonsHelper. Original artist: AlanFord at English Wikipedia
- **File:Spay_1.JPG** Source: https://upload.wikimedia.org/wikipedia/commons/2/24/Spay_1.JPG License: CC-BY-SA-3.0 Contributors: Own work Original artist: Joel Mills
- **File:Srisita_ram_laxman_hanuman_manor.JPG** Source: https://upload.wikimedia.org/wikipedia/commons/9/99/Srisita_ram_laxman_hanuman_manor.JPG License: CC-BY-SA-3.0 Contributors: Transferred from en.wikipedia to Commons by Man77 using CommonsHelper. Original artist: The original uploader was Matheesha at English Wikipedia
- **File:Stone_bas_relief_at_Banteay_Srei_in_Cambodia.jpg** Source: https://upload.wikimedia.org/wikipedia/en/c/c8/Stone_bas_relief_at_Banteay_Srei_in_Cambodia.jpg License: Cc-by-sa-3.0 Contributors: ? Original artist: ?
- **File:Swayamvara_Draupadi_Arjuna_Archery.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/7/77/Swayamvara_Draupadi_Arjuna_Archery.jpg License: CC BY-SA 2.0 Contributors: originally posted to Flickr as Archery Original artist: Charles Haynes
- **File:Text_document_with_red_question_mark.svg** Source: https://upload.wikimedia.org/wikipedia/commons/a/a4/Text_document_with_red_question_mark.svg License: Public domain Contributors: Created by bdesham with Inkscape; based upon Text-x-generic.svg from the Tango project. Original artist: Benjamin D. Esham (bdesham)

- **File: The_center_of_battle_of_Kurukshetra.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/c/c8/The_center_of_battle_of_Kurukshetra.jpg License: CC BY 2.0 Contributors: originally posted to **Flickr** as The center of battle of Kurukshetra Original artist: Divya and Deepak
- **File: Totheforest.jpg** Source: <https://upload.wikimedia.org/wikipedia/commons/0/0c/Totheforest.jpg> License: Public domain Contributors:
- http://www.columbia.edu/itc/mealac/pritchett/00routesdata/bce_299_200/mahabharata/razmnamah/razmnamah.html Original artist:
 - Author: Naqib Khan (translator).
 - Illustrator: Dhanu.
- **File: Trifolium_April_2010-2.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/1/1a/Trifolium_April_2010-2.jpg License: CC BY-SA 3.0 Contributors: Own work Original artist: Alvesgaspar
- **File: UNO_graduate_students_visit_Louisiana_National_Guard_Museum,_Jackson_Barracks_150410-A-QM174-008.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/2/22/UNO_graduate_students_visit_Louisiana_National_Guard_Museum%2C_Jackson_Barracks_150410-A-QM174-008.jpg License: Public domain Contributors: <https://www.dvidshub.net/image/1877347> Original artist: Sgt. Karen Sampson
- **File: USS_George_Washington_(SSBN-598).jpg** Source: https://upload.wikimedia.org/wikipedia/commons/6/69/USS_George_Washington_%28SSBN-598%29.jpg License: Public domain Contributors: ? Original artist: ?
- **File: Unrolled_main_cardioid_of_Mandelbrot_set_for_periods_8-14.png** Source: https://upload.wikimedia.org/wikipedia/commons/c/cb/Unrolled_main_cardioid_of_Mandelbrot_set_for_periods_8-14.png License: CC BY-SA 3.0 Contributors: Own work Original artist: Adam majewski
- **File: Valmiki_Ramayana.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/2/24/Valmiki_Ramayana.jpg License: Public domain Contributors: ... Original artist: ?
- **File: Varroa_on_larvae.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/c/c9/Varroa_on_larvae.jpg License: CC-BY-SA-3.0 Contributors: English Wikipedia Original artist: Pollinator (own work)
- **File: Verhulst-Mandelbrot-Bifurcation.jpg** Source: <https://upload.wikimedia.org/wikipedia/commons/b/b4/Verhulst-Mandelbrot-Bifurcation.jpg> License: Public domain Contributors: Own work Original artist: Georg-Johann Lay
- **File: Vista_Login_Manager_Cropped.svg** Source: https://upload.wikimedia.org/wikipedia/commons/1/15/Vista_Login_Manager_Cropped.svg License: GPL Contributors: Image: Vista-Login Manager2.png, from [1] Original artist: Sa-Ki at DeviantArt, traced by User: Stannered
- **File: Vultur_gryphus_-Doué-la-Fontaine_Zoo%2C_France-8a.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/8/81/Vultur_gryphus_-Doué-la-Fontaine_Zoo%2C_France-8a.jpg License: CC BY-SA 2.0 Contributors: originally posted to **Flickr** as con aires de abuelele Original artist: Emilio del Prado
- **File: VultureBeak.png** Source: <https://upload.wikimedia.org/wikipedia/commons/3/33/VultureBeak.png> License: Public domain Contributors:

Guide to the gallery of birds <http://www.archive.org/details/guidetogalleryof00britrich.djvu>

Original artist: W R Ogilvie Grant
- **File: Wakes_near_the_period_1_continent_in_the_Mandelbrot_set.png** Source: https://upload.wikimedia.org/wikipedia/commons/9/94/Wakes_near_the_period_1_continent_in_the_Mandelbrot_set.png License: CC BY-SA 4.0 Contributors: Own work Original artist: Claude Heiland-Allen
- **File: Wat_phra_keaw_ramayana_fresco.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/0/01/Wat_phra_keaw_ramayana_fresco.jpg License: Public domain Contributors: <http://www.flickr.com/photos/34816987@N00/1392410389> Original artist: unknown, photo by "Thaths"
- **File: Wayang_Wong_Bharata_Pandawa.jpg** Source: https://upload.wikimedia.org/wikipedia/commons/2/23/Wayang_Wong_Bharata_Pandawa.jpg License: CC BY-SA 3.0 Contributors: Own work Original artist: Gunawan Kartapranata
- **File: Wheat_yields_in_Least_Developed_Countries.svg** Source: https://upload.wikimedia.org/wikipedia/commons/0/0b/Wheat_yields_in_Least_Developed_Countries.svg License: CC BY-SA 4.0 Contributors: Own work Original artist: Grendelkhan
- **File: Wiki_letter_w.svg** Source: https://upload.wikimedia.org/wikipedia/en/6/6c/Wiki_letter_w.svg License: Cc-by-sa-3.0 Contributors: ? Original artist: ?
- **File: Wikibooks-logo-en-noslogan.svg** Source: <https://upload.wikimedia.org/wikipedia/commons/d/df/Wikibooks-logo-en-noslogan.svg> License: CC BY-SA 3.0 Contributors: Own work Original artist: User: Bastique, User: Ramac et al.
- **File: Wikiquote-logo.svg** Source: <https://upload.wikimedia.org/wikipedia/commons/f/fa/Wikiquote-logo.svg> License: Public domain Contributors: Own work Original artist: Rei-artur
- **File: Wikisource-logo.svg** Source: <https://upload.wikimedia.org/wikipedia/commons/4/4c/Wikisource-logo.svg> License: CC BY-SA 3.0 Contributors: Rei-artur Original artist: Nicholas Moreau
- **File: Wikispecies-logo.svg** Source: <https://upload.wikimedia.org/wikipedia/commons/d/df/Wikispecies-logo.svg> License: CC BY-SA 3.0 Contributors: Image: Wikispecies-logo.jpg Original artist: (of code) cs: User: -xfi-
- **File: Wiktionary-logo-v2.svg** Source: <https://upload.wikimedia.org/wikipedia/commons/0/06/Wiktionary-logo-v2.svg> License: CC BY-SA 4.0 Contributors: Own work Original artist: Dan Polansky based on work currently attributed to Wikimedia Foundation but originally created by Smurrayinchester
- **File: World-Population-1800-2100.svg** Source: <https://upload.wikimedia.org/wikipedia/commons/5/56/World-Population-1800-2100.svg> License: CC BY-SA 3.0 Contributors: based on file: World-Population-1800-2100.png, but converted to SVG using original data from U.N. 2010 projections and US Census Bureau historical estimates Original artist: Tga.D based on Aetheling's work
- **File: World_population_growth_rates_1800-2005.png** Source: https://upload.wikimedia.org/wikipedia/commons/1/13/World_population_growth_rates_1800-2005.png License: CC-BY-SA-3.0 Contributors: Created from data and historical estimates published by the US Bureau of the Census. Original artist: Loren Cobb / Aetheling at en.wikipedia

- **File:Włoszczyzna.jpg** *Source:* <https://upload.wikimedia.org/wikipedia/commons/2/27/W%C5%82oszczyzna.jpg> *License:* CC BY-SA 4.0 *Contributors:* Own work *Original artist:* Kpalion
- **File:Yulmu_(Coix_lacryma-jobi).jpg** *Source:* https://upload.wikimedia.org/wikipedia/commons/6/6a/Yulmu_%28Coix_lacryma-jobi%29.jpg *License:* CC BY-SA 2.5 *Contributors:* <http://krdict.korean.go.kr/eng/dicSearch/viewImageConfirm?nation=eng&searchKindValue=image&ParaWordNo=70923&ParaSenseSeq=1&multiMediaSeq=1> *Original artist:* National Institute of Korean Language
- **File:Yulmucha_(Job'{}s_tears_tea).jpg** *Source:* https://upload.wikimedia.org/wikipedia/commons/a/a0/Yulmucha_%28Job%27s_tears_tea%29.jpg *License:* CC BY-SA 2.5 *Contributors:* <http://krdict.korean.go.kr/eng/dicSearch/viewImageConfirm?nation=eng&searchKindValue=image&ParaWordNo=70924&ParaSenseSeq=1&multiMediaSeq=1> *Original artist:* National Institute of Korean Language

43.12.3 Content license

- Creative Commons Attribution-Share Alike 3.0